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CARRYING ON A SIXTY-TWO MILE CONVERSATION BY WIRELESS TELEPHONY.—[See page 352.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Value of Speed—in the Right Ships

A STRIKING lesson of the naval war is the great value of high speed—if it be found in the proper kind of ship. The first demonstration of its value was the escape of the battle-cruiser "Goeben" and the scout-cruiser "Breslau," whose speed carried them, apparently unscathed, through nearly the whole length of the Mediterranean Sea, although its waters were alive with the powerful ships of the Allies. Had these ships possessed less than the twenty-eight knots speed which saved them from the guns of the enemy, they would be to-day somewhere at the bottom of the Mediterranean; as it is, they are afloat, probably intact, and, if reports may be believed, now form part of the Turkish fleet. If so, and should the Turks join the Dual Alliance, these two ships must be counted in as part of the Turkish naval fighting forces.

The United States Navy possesses not a single high-speed battle-cruiser. Our naval constructors are fully alive to the strategical and tactical value of high speed in heavily armed and armored ships; but in common with the whole of the technical and advisory staff of the Navy, they realize that, until our battleship strength has been brought up to the proper stage, it is best to build battleships whose heavy armor will enable them to fight it out to the last in a line-of-battle engagement, rather than more lightly armored battle-cruisers, which, through severe penetration of belt or turret armor, might be driven out of the line of battle.

By way of illustrating the value of high speed in capital ships of the first fighting line, let us indulge in a few moments of imaginary strategy and tactics. Let us suppose that, on learning through his Zeppelin scouts that Admiral Jellicoe had sent a large portion of his battleship fleet south to the English Channel, to assist, let us say, in repelling the right flank of the German advance into France, Admiral Tirpitz decided to issue in full strength into the North Sea and make a dash by way of the north coast of Scotland for a raid upon the northern French coast, or for some other objective. (It is unlikely that he will attempt any such thing, but for the purpose of our present argument we will suppose that he might do so.)

Now, because of the fact that the German ships would pass into the North Sea fresh from drydock, and therefore with clean bottoms and in first-class condition, the average speed of its sixteen dreadnoughts might well be assumed at from 20 to 21 knots. The British fleet, because of its having had to keep the sea continuously, in readiness to meet the German fleet should it venture forth, would be found with the bottoms of its ships more or less foul. The average speed of the fleet would be reduced to that of its slowest ship, and due to dirty bottoms, etc., might not exceed 18 to 19 knots.

Immediately on discerning the smoke of the outcoming German fleet, the patrol and scouting ships (destroyers, old cruisers, etc.) would notify the commander-in-chief at his mine-protected base at the mouth of the Wash, let us say, or in the estuary of the Humber. Let us suppose that, directed by wireless, the fleet converges upon that of the Germans, and that, in the stern chase which follows, the rear of the German line is beyond the range of the guns of the leading British ships. The Germans, as we have seen, would have an advantage of a knot or two of speed, and they would draw steadily away, Admiral Tirpitz deciding not to accept battle with the disadvantage of sixteen ships of the line against twenty or more.

Now it would be under conditions like these that the high speed of 28 knots, possessed by battle-cruisers of the "Lion" and "Queen Mary" type and the speed of 25 knots of the battleship "Queen Elizabeth" and class, would prove of incalculable value; for Admiral Jellicoe would send forward half a dozen of these faster units to concentrate their attack upon the rearmost ships of the German fleet. In order to save his rear from being overwhelmed by the concentrated fire of the enemy's 13.4-inch guns, Admiral Tirpitz would be forced to slow down and accept a general engagement. It has been stated in the British naval journals (and we believe it to be a fact) that the object of giving the dreadnoughts of the "Queen Elizabeth" class the high speed of 25 knots, is principally this object of forcing a fleeing enemy to accept a general engagement.

In no phase of the naval war has the value of high speed been more forcibly demonstrated than in the work of commerce destroying, as carried out by the fast German scout cruisers which have been operating successfully in all the seven seas. These ships and their field of operations are as follows:

The "Karlsruhe," 28 knots, and the "Dresden," 24 knots, in the Atlantic; the "Nurnburg," 24 knots, and the "Leipzig," 23 knots, in the Pacific; the "Emden," 25 knots, in the Indian Ocean; and the "Koenigsberg," 23.5 knots, in South African waters. These vessels vary in displacement from 4,900 tons to 3,400 tons. The "Karlsruhe" is protected by a 4-inch belt and carries twelve 4.1-inch guns. The others are protected cruisers, with a 2-inch deck, and they all have a similar battery of ten 4.1-inch guns. From the very outset of the war the British and French cruisers, of less speed but much greater gun power, have been seeking to bring them to action and sink them. Several times one or other of the German ships has been surprised and has made a running fight of it, and, in every case, they have been able to get away, apparently without vital damage. Seemingly they are being coaled by ships which meet them by appointment at specified localities, and now and again they are able to stock up from a captured collier. It is the old story of the "Alabama" on a larger scale; and it is conceivable that the speed of these fast boats may enable them to continue their depredations, uncaptured, until the end of the war.

The Navy Wants Dirigibles

SIX years ago the United States made its first and only experiment with dirigible balloons; when the Signal Corps of the Army purchased the U. S. Dirigible No. 1 from its builder, Capt. Thomas Baldwin. Since that time the only aviation work of the Government has been with spherical balloons and aeroplanes. A year ago the Board of Navy Aeronautics, of which Capt. Washington I. Chambers, U. S. N., was chairman, recommended the purchase of dirigible balloons for navy work. In furtherance of these plans, the Navy Department, through Capt. Mark L. Bristol, in charge of navy aeronautics, has asked eight American manufacturers of balloons and aeronautical apparatus what they can do toward furnishing the United States with dirigibles. The Navy is considering the purchase of at least two such, of a minimum displacement of 75,000 cubic feet. The Navy is firmly of the opinion that airships can be manufactured as well here as abroad. But the Navy also believes that, for lack of experience and facilities, there is not at present any design of airship in this country suitable for naval purpose.

The Navy Department has asked American manufacturers if they will undertake to obtain plans, specifications, and the rights to manufacture one or two airships for the Navy. The Parseval, Astra-Torres, Clement-Bayard, and Forlonini types are all favorably considered by the Navy. It has asked if manufacturers will submit estimates for supplying one airship of one or more of the above types, the plans and specifications to be of the latest type abroad, and the manufacture to be in this country; also a second estimate for two of the same type, and a third for two of different types. Manufacturers may submit estimates for any other types than those herein mentioned.

Questioned about the proposed airships, Capt. Bristol said that if airships prove successful in the present war in Europe, there will probably be a demand for several for our Navy in the near future. He stated that the one or two airships immediately required are for the training of personnel and to gain experiment for future development of them. This is the reason a small size is considered. For regular service, airships of 100,000 cubic feet displacement or over will be required.

It is impossible to say whether such airships will be used from a ship as a base. It is certainly possible to fly a dirigible from a ship, especially if it is made for the purpose. Whether it is advisable, or whether it will be considered necessary, we do not know and cannot state.

Capt. Bristol said he knew that the Navy would welcome the opportunity to buy a couple of dirigibles of the right kind, made in America. He has the necessary appropriation, and the Navy would have bought them long ago, had we had the men to manufacture them here. He feels that we need some experimental airships for training men before we go deeply into the matter. You can't pick a man up off the ground and make an airship operator of him in a day. He has to be trained, and well trained. The first airships bought will be for training men and for experimental work. The only experience this country has had in such work is that of the Army dirigible, and that was too small, in the light of present day's experience, for consideration now.

The U. S. Dirigible No. 1, of 20,000 cubic feet capacity and 19.3 knots speed on test, was a mere toy in the light of the subsequent developments of the Zeppelin and the Parseval. Capt. Bristol is emphatic in his statement that he does not want American manufacturers to consider that the Navy wants another toy, merely because it wants airships for experimental work and man training. Indeed, the statement that a minimum of 75,000 cubic feet displacement is wanted, in the proposed specifications to be submitted, is evidence of that. Of course, a bag with even 100,000 cubic feet displacement is small compared to some dirigibles, such as the Zeppelin, with its upwards of 500,000 cubic feet displacement. But a dirigible of 100,000 cubic feet displacement will train men as well as a larger one, and its manufacture should afford its maker such valuable experience that subsequent attempts would be even more successful.

The Navy wants dirigibles, and is willing to pay for them; more, it is willing to enter into any reasonable arrangement which will assist manufacturers to give the Navy what it wants. There has been a great deal of talk in the trade journals devoted to aeronautics about the apathy of the Government in this department of modern progress. The war abroad is focusing attention of everyone everywhere upon the airship and the aeroplane and is emphasizing the small resources of the United States in these aids to offense and defense. Here is an opportunity; among the 100,000,000 people of the United States, surely there are a few who will be encouraged to co-operate with the Government in the development of this arm of the service.

Naval Co-operation With the Allied Land Forces

THE latest demonstration of the great value of the command of the sea was the co-operation of the British fleet with the allied forces forming the extreme left flank of the Allies in Belgian territory. According to a statement issued by the Secretary of the Admiralty, requests for naval assistance were made by the allied commanders. In response to this a naval flotilla, mounting a large number of powerful, long-range guns, came into action off the Belgian coast in support of the left of the Belgian army, the gun fire being directed against the right of the German attack, which the ships, due to their position, were enabled to enfilade. The report states that the Germans replied with shells from their heavy guns, but that, owing to the superior range of the British naval artillery, practically no serious damage was done to the ships.

An interesting feature of these operations was the presence in the British attacking fleet of three monitors, the "Javary," the "Medeira," and the "Solimoes," which were building in England for Brazil, and were taken over at the outbreak of the war. These vessels, judging from their dimensions, etc., are true monitors, of the type developed during our Civil War. They are 265 feet in length, 49 feet in breadth, and draw 4½ feet, with a displacement of 1,250 tons. They mount two 6-inch high-velocity rifles and two 4.7-inch howitzers. Their speed is 11½ knots.

It is not stated whether the attacking fleet included any capital ships of large size, mounting the heaviest guns. If any of the older battleships were included, the German right must have been subjected to the fire of 35- to 40-caliber 12-inch guns. These pieces have a maximum angle of elevation of 15 degrees as mounted in their turrets, at which elevation their maximum effective range would be, say, from ten to twelve miles. The gun fire was directed by observation from captive balloons, and under the guidance of the observers, it would be possible, by alteration of elevation or by reducing the powder charge, to cover many miles of the German front with a destructive 12-inch shrapnel fire.

A New Altitude Record by an Army Aviator.—Using one of the army scout biplanes with a 90 horse-power motor Capt. H. L. Muller of the First Aeroplane Corps of the Army bettered by 2,303 feet, on October 8th, the record of 15,137 feet made with a gyromotored Day tractor by DeLloyd Thompson at Kansas City. The new record is 17,440 feet, while the world's height record is 26,240.

Electricity

Improved Electric Lighter for Gas Stove.—A patent, No. 1,110,490, has been issued to Leroy R. Jewett of Lynn, Mass., in which a valve must be moved beyond full open position to close the electric circuit for lighting the gas of a gas stove, the valve being returned to full open position for normal use, thus making sure that there will be sufficient gas to be lighted and at the same time avoiding the necessity of making the circuit when the gas is cut off.

Wireless Telephony for Moving Trains.—For many years, F. H. Millener, experimental engineer of the Union Pacific Railway, has been working on wireless telephone apparatus for direct communication with moving trains. He announces that his plans have been completed and a satisfactory system has been developed, whereby he is able to talk with a moving train a hundred miles away from the wireless transmitting station. Wireless stations are to be established at Grand Island and North Platte, Neb., Cheyenne and Green River, Wyo., and Ogden, Utah.

Fire Fighting with Fans.—The use of electric fans by a fire department in putting out a blaze is surely novel. In Boston not long ago a fire broke out in the basement of a building occupied by a wholesale paint and chemical concern. The fumes and smoke became so thick that it was impossible for the firemen to enter the basement. A half dozen of the ordinary sixteen inch size electric fans were quickly requisitioned by the fire chief and their breeze directed down the stairway. As soon as the rear basement windows were broken to allow the escape of the smoke and fumes, the effect of the fans gradually cleared the basement, so that the firemen could work quickly and effectively in extinguishing the flames.

Atmospheric Electricity over the Ocean.—A report on the atmospheric-electric observations made during the second cruise of the "Carnegie" is published by C. W. Hewlett in *Terrestrial Magnetism and Atmospheric Electrictiy*, and constitutes an important contribution to the study of electrical conditions at sea, as the observations cover a period of more than two years, and were made on the Pacific, Atlantic, and Indian Oceans. Combining the results with those obtained by other observers, it may be stated that the potential gradient is of the same order of magnitude over the sea as over the land; the radioactivity of the air over the ocean areas far removed from land is small, compared to that found over land; while the ionization over the ocean is at least as large as that found over land. The specific conductivity of the atmosphere is found to be independent of its radioactivity. The mean value of the specific conductivity given by the "Carnegie" observations was 3.07×10^{-4} E. S. U., which is larger than the mean value found over land.

New Method of Adjusting a Detector.—An English wireless operator is making use of a method for adjusting contact between crystals in the detector which he claims is an excellent one. In this case the contact between two crystals is obtained, not by hand, but by the use of an electromagnet which produces the pressure and can be given a very fine adjustment. One crystal cup is mounted on the base of the apparatus, and above it the second cup lies on the end of a short vertical slide arm, placed on the end of a rather long tongue or spring strip. Midway on the tongue is an iron armature which can be drawn down by an electromagnet on the base. A rough adjustment is made by sliding the top crystal in its screw slide and fixing it, then current is put on the magnet so as to draw down the spring blade and so adjust the contact between the top and bottom crystals. A rheostat of the sliding kind is used to give a close adjustment of the current.

Air Gap Measures.—A point which is often very useful to know but at the same time difficult to find out by convenient means is the strength of the magnetic field in a dynamo or motor in the air gap between armature and field. After a machine has been built, it is important to know whether this strength corresponds with what was given in the theoretical design. In order to take the strength of this field by direct measurement, Messrs. Morphy and Oschwald had the idea of inserting a small bore test tube into the narrow air gap. Inside this tube is a long armature of rod shape, pivoted at each end, and carrying a wire coil. A hair spring is mounted so as to work with it. When a current is sent in the pivoted coil this reacts with the lines of force in the air gap and causes the coil to pivot about to a certain angle depending on the strength of the magnetic field, there being a constant current sent in the coil. On the enlarged outer end or handle of the exploring rod is a mirror which turns with the coil and throws a spot of light on a graduated scale. This scale is carried on a swinging arm so as to lie some distance off and can be adjusted. The lamp is mounted at the outer end of the arm and sends the beam down upon the mirror, whence it is reflected upon the scale in the usual way. By swinging the arm around it can be clamped with the explorer in any part of the air gap and the field strength may be very quickly observed.

Science

The Carothers Observatory at Houston, Texas, reports a new method for observing sun-spots without the aid of a telescope, as follows: If images of the sun be formed through clean-cut round holes of proper size in a darkened room at sufficient distance from the aperture and cast upon clean white paper or cardboard, sun-spots of ordinary size may be readily seen on the image. This method would enable amateurs to note the progress of the spots across the solar disk, and if daily drawings be made the result would soon be a delightfully interesting record.

In shops where it is damp or chemical fumes are present it is usually difficult to cause labels to stick to bottles or cans. An ink for use on such containers is made as follows: shellac 20 grammes, dissolve it in a hot solution of borax containing 30 grammes of borax to 400 cubic centimeters of water, filter while hot and add a solution made of aniline black, 8 grammes, tannin 0.3 gramme, picric acid 0.1 gramme, and ammonia 15 grammes, in water 10 grammes. It will be found that this ink works nicely and resists the usual chemical and corrosive fumes.

The Influence of X-Rays on the Propagation of Sound.—The theoretical deductions of Boltzmann and Maxwell on the constitution of gases lead to certain conclusions respecting the rate of proportion of sound waves through gases. For the most part gases obey these theoretical laws, but oxygen presents anomalies. This departure from the normal behavior of gases on the part of oxygen was attributed by Richard to the neutral ionization of the gas, and consequently a systematic study has been made by Kupper on the influence of various ionizators on the velocity of sound in various gases. On submitting atmospheric air, oxygen and nitrogen to the action of X-rays, the velocity of sound propagation through those gases is greatly increased. The ultra-violet rays from a quartz mercury vapor lamp give rise, in the case of oxygen and of mixtures containing oxygen, to the formation of ozone and in consequence to a reduction in the velocity of sound. In the case of nitrogen and hydrogen the velocities are increased, although not to the same extent as when X-rays are employed. The rays of radium exert no appreciable effect, and neither do the variations produced by an alternating electric field.

Gems in Ultra-Violet Light.—Recent experiments made with vacuum tubes and ultra-violet light bring out the fact that the diamond, ruby and emerald, as well as certain minerals such as kinzigite, have surprising fluorescent properties. In rarefied air, certain diamonds emit a blue fluorescent light resembling what sulphate of quinine gives under the same circumstances, and *in vacuo* a diamond of 4 or 5 carats is stated to give a luminous effect which is equal to 20 candle-power. The ruby gives a fine red phosphorescent light, while the emerald produces a crimson light. It is also observed that the mineral kinzigite emits a yellow radiation, sometimes tinged with rose color. The same stones are found to glow with phosphorescent light when exposed to the action of radium. Experts are now able to make use of these properties of gems or other minerals in order to estimate the value of certain stones, for instance, the Burma ruby can be compared with the Siam ruby, the former being much more valuable. When examined by usual light it is hard to detect a difference between the two gems, but when exposed to ultra-violet light the Burma ruby glows with a red light like a hot coal, while the Siam variety remains almost black. Such a method is likely to prove valuable for the lapidary and also in mineralogical work.

Edward J. Hall, Telephone Pioneer.—Edward J. Hall, vice-president of the American Telephone and Telegraph Company and chairman of the Executive Committee of the Western Union Telegraph Company, who died recently, was one of the pioneers of the telephone business. Mr. Hall was the son of Edward J. Hall, a Perth Amboy manufacturer, and was born March 31st, 1853. Later the family removed to Buffalo, and the son graduated from the Yale Scientific School in 1873. Appreciating the possibilities of the telephone, Mr. Hall secured the right to operate in Buffalo from the parent Bell Company in 1878, and organized a telephone company, of which he became vice-president and general manager. When, on January 1st, 1885, Theodore N. Vail, then general manager of the American Telephone Company, was developing the project to organize the American Telephone and Telegraph Company, he asked Mr. Hall to take charge of the development of the new system. At that time the development of long-distance telephone lines was still in its infancy, but Mr. Hall saw the possibilities in the development of this branch of the service and undertook to carry it out on a large scale. On January 1st, 1887, under Mr. Hall's direction, the line from New York to Philadelphia was opened to the public. Mr. Hall married Louise Winne in Buffalo, who survives him, with two daughters and a son. His home was at Morristown, N. J. Mr. Hall was a director in a number of telephone and manufacturing enterprises and a member of several clubs.

Aeronautics

Our Military Aeroplane Competition Called Off.—Owing to the failure of the competitors to submit the proper plans and specifications, the Government competition for tractor biplanes was called off on October 22nd. Three of the eleven entrants appeared, while a fourth machine had been shipped from New York. The competition will probably be held at a later date.

The Value of Aeroplanes in War.—In all of his reports Gen. French has laid stress upon the great service rendered by the aviators in ascertaining the moves of the enemy as soon as they start to make them. The reconnaissance work they have performed has been invaluable. According to the official statement of the British War Office, their aviators are covering an average of 2,000 miles a day. Up to September 21st they had flown 87,000 miles and remained 1,400 hours in the air. By now these figures have been doubled. A certain French corps commander's opinion is that a single aeroplane is as valuable as an entire division of cavalry.

A New American Cross-country Record.—Since the European war began there has been no aviation news in the United States as far as actual flying is concerned. We are therefore doubly pleased to be able to record the addition of 1400 miles to the distance across-croountry scored by C. Murvin Wood on August 9th of last year, when he flew from Hempstead, L. I., to Gaithersburg, Md., near Washington, D. C. The new record—365 miles—was made by W. C. Robinson, the well known Wright and Nieuport pilot of Grinnell, Ia. He flew from Des Moines, Ia., to Kentland, Ind. He intended to fly direct to Chicago, but was driven off his course by a storm. The flight was made in a new monoplane of Robinson's own construction.

Directing Gun Fire by Means of Aeroplanes.—An Associated Press despatch published in most of the New York newspapers states that the German aviators have been directing the artillery fire about Mons. This is exactly what military experts expected. It will be remembered that during the Russian Japanese war the eminence known as "203 meter hill" was captured and recaptured again and again by both Russians and Japanese, finally to remain in the hands of the Japanese. The hill was wanted not to plant guns on it, but simply to enable a man with a telescope to direct the fire of the Russian battleships on Port Arthur. An aeroplane would now perform the same function much more effectively and, of course, with little or no loss of life.

Daring Raids of British Airmen.—The long-distance flights of leading German aviators, headed by Lieut. von Heidesen, to Paris, and the sudden appearance of their machines, from which manifestos and bombs were dropped, above the capital city as well as over Antwerp, Ostend, and Dunkirk, was offset and greatly surpassed in the amount of damage done by two raids made upon Dusseldorf and Cologne by British airmen. The first of these was made on September 23rd by a squadron of the Royal Naval Air Service consisting of five machines led by Lieut. C. E. Collett. In a thick mist they set out from Antwerp for the above mentioned places situated well over 100 miles within the enemy's country. After dropping a few bombs on Maestricht, Holland, by mistake, the aviators reached Dusseldorf and Cologne and dropped the rest. At Dusseldorf they succeeded in damaging a Zeppelin shed and its airship, as well as a machine shop near by. The aviators returned to their starting point unharmed. Their appearance had been so sudden and unexpected that they were fired upon scarcely at all. No such raid by a number of machines appears to have been made by the Germans, although they possess easily three times as many aeroplanes as the English.

Destruction of Zeppelins by British Aviators.—The second raid on Dusseldorf and Cologne—the first had resulted in the flying of large white flags from the cathedrals at Cologne, Strassburg, and other cities along the Rhine, as well as of bigger Red Cross flags on the hospitals—was made by the three machines of Lieuts. R. L. G. Marix, Sidney V. Sippe, and Spencer Grey, which left Antwerp on October 8th shortly before the bombardment of that city began. Lieut. Marix did the most damage and had a marvelous escape. The 100-mile trip across country was made at a height of a mile. As soon as he was over Dusseldorf, Lieut. Marix sighted the Zeppelin shed and swooped down to within 500 feet of it, dropping a couple of bombs at the end of the long volplane. He was subjected to a heavy rifle fire and a stream of bullets from Maxim guns. One bullet passed through his cap and one of the twin control wires of his elevator was severed; but he managed to fly away and return to Antwerp. An explosion and sheet of flame right after he dropped the bombs appraised him that he had hit the shed and blown up the airship inside. It was first claimed this was an old Parseval, but confirmation was had later that one, and perhaps two, Zeppelins were destroyed. The other two aeroplanes came down before they reached home, but the pilots descended within the Allies' lines.

Letters from the Firing Line

Traits of the French Soldier

By Aide-de-Camp Xavier Sager, Special Correspondent of the SCIENTIFIC AMERICAN at the Front

THE day after the victory of the Marne Gen. Joffre, commander-in-chief of the French army, wrote this sentence, which, though concise, is very full of military meaning: "The government of the Republic may well be proud of the army that it created."

During the two months that Germany has been throwing forward the great weight of her formidable masses, which to-day we have beaten back, there has hardly been a day when I was not closely associated with one or more of the different classes of soldiers composing the French army. I have seen them on duty; I have heard their conversations; I have slept on the hard ground with them; I have shared their bread, and what I would like to tell the world to-day in these few notes which I have jotted down at haphazard is the true worth, both physical and moral, of the French soldier.

What distinguishes him above all else is his full realization of the part he has to act. The German is a good soldier as far as discipline is concerned, for this has been deeply instilled into him; but in a certain way it is a passive kind of a discipline—he lacks, in consequence, individual initiative. Nothing is expected of him but obedience. We have a proof of this every moment. For instance, in the encounters with the patrol, if the German officer happens to be killed, the men who, when under his command, had fought courageously, surrender immediately. This is not a lack of courage on their part; but left to themselves they become immediately demoralized and do not know what to do.

It is entirely different with the French. Before everything else, each soldier feels himself a free citizen who has voluntarily taken arms for the defense of those ideas of justice and liberty which he has inherited from his ancestors. For these reasons he gives to his country the full measure of his intelligence and his courage. From this point of view the French army is very truly a "nations in arms."

Nothing is more picturesque, more typical than a French cantonment. Here all social differences have entirely disappeared. There are no rich, no poor, no peasants, and no society men. Here absolute equality reigns. One soul animates them all—the soul of the soldier. A little while ago some one remarked to me that the German is a soldier by education, but the Frenchman is a soldier by nature. That is perfectly true. I met the other day, in a cantonment near Chalons, a young professor of the Sorbonne, a very erudite lecturer, elegant and popular in Parisian Society, now a simple soldier of the second class, who had just finished carrying water for the troops. Here I saw this young *savant*, who was always so elegant in his appearance and manner, his cap over his ear, singing at the top of his lungs with his comrades a song that would make a brigadier blush.

A few days in the field had transformed him, or rather had been sufficient to awaken in him the military instinct which slumbers in the depths of the heart of every Frenchman, even the most cultivated and peace-loving. I have seen also some poets who had broken with poetry, some diplomats, some inventors, some priests, some actors, all animated with the same high spirit, all having forgotten their past positions to become exclusively soldiers, and handling guns, pickaxes, and the pots and pans of the army kitchen as if they had never done anything else. This fraternity, this comradeship, does not exist only between equals. This fact immediately strikes everyone who comes into the French lines. The subordinates accept their superior willingly, because there is no social hierarchy; there is only a hierarchy of competence. From this it is easily understood how authority can be reconciled with the most cordial comradeship; all are friends without allowing discipline to suffer in the least. We know that this is not the case in the German army. The German officer belongs to a superior caste, which in no circumstances whatever can mingle with the common soldiers. With us a lieutenant or a captain is perfectly willing to sleep on the straw by the side of his men, and he will not refuse to drink a few swallows of wine or coffee from the gourd of a simple trooper. On the other hand, a Prussian lieutenant considers himself dishonored by the mere touch of one of the men under his command, whom he often treats as if he were a valet devoid of dignity, and indeed he often gives him a kick or a slap.

I saw the other day in a railroad station a German captain, who was a prisoner, demanding some water from the French sergeant in charge of him. The latter handed him his cup, which he had previously rinsed with the greatest care. The officer threw away the water in disgust. Such behavior greatly concerned this good sergeant, who thought he had done the proper thing. But a French general who was there had seen the occurrence. He approached the sergeant, and slapping him on the shoulder, "It is very warm," he said. "I should like to have a drink." Meanwhile he looked fixedly at the Bavarian officer, who reddened as the general slowly emptied the tin cup. I call attention to this trait, because I was one of the few witnesses, and because it is characteristic of the very different ways in which the officers of the two armies treat their men. Moreover, as a general rule, such haughty manners is of no avail in the presence of the French trooper. Their proud behavior, their arrogant attitude, and their contemptuous words miss their aim.

A few days ago, after an engagement with a German patrol, a zouave captured a young German lieutenant wearing a monocle. As he started back toward the French lines the officer, thinking that the soldier was walking too close to him, and did not keep a respectful distance, moved away with no attempt to disguise his repugnance. But the zouave was so little intimidated that he said: "Too bad for mademoiselle; wait a minute." Then he made him carry his knapsack and all his equipment, crowning his head with his porringer (*gamelle*). It was a somewhat crude joke, for which the zouave was reprimanded; but this proves at least how little the German officer knows regarding the mentality of the French soldier.

"We have just accomplished a colossal sport. All world's records have been smashed, and notably that of the 200 meters, in plowed-up fields, with knapsack on the back. I believe that André (André is the athletic champion of 1914) could not have done better. It is after having accomplished this remarkable performance that I received in my left arm an impertinent bullet. We were charging at full speed, regardless of the shells which were whistling their funny little tunes around our heads, and we would have succeeded if it had not been for those devils of Bavarians who were keeping their ground with the energy of desperation. I already held one at the point of my bayonet when a sudden blow made me lose hold of my gun. Carried away by the impetus I had time, before I fell, to deliver a formidable 'direct from the right' upon the corner of the jaw of a tall imbecile who seemed to be laughing at me. Then I kind of lost the notion of things.

"I came to in the arms of a giant, a fellow of the chorister section of the opera, who had picked me up and carried me in the ambulance, while he was howling in a formidable voice: '*Arrachons Guillaume à ses fers*' (let us tear William from his chains). As you are a musician you might know that this is from the opera of 'William Tell.' We have here a basso who used to sing in Lyons; he spends all the morning in taking care of our *poniards*—pardon, I mean our bayonets. He is all right, but his voice is enough out of pitch to put in flight a whole regiment of the Parisian guards. Amen. You see that my spirits are good. I desire only one thing, and it is to get well as soon as possible to begin again fighting the enemy."

The cavalryman loves his horse as much as the artilleryman loves his cannon. In the battle of Epernay a battery of 75 was suddenly surrounded by a German division. After a desperate resistance our chief judged it necessary to call his men back. The artillerymen carried away with them the breech (*culasse*) of their cannons, which later on they had to abandon with cries of rage, for all the horses had been killed. They wanted a revenge and they did not have to wait very long to get it. That very evening, during a charge with the bayonet, we saw the four pieces of 75 which had been put together in a farm under cover of a barn, and were guarded by a dozen or so of German soldiers. We did not lose time in deciding what to do. Fifteen artillerymen swore that they would take their cannons back. When night came these men crawled unseen through the intrenchment of the enemy, and reached the spot where the Germans had placed our pieces. Two of the artillerymen sprang on the sentries in charge of watching the farm; taken by surprise, according to our plan, they were killed, without having time to utter a cry. At midnight the fifteen men returned to the camp with our precious 75.

The French aviators do not seek publicity, they do not try to attract upon themselves the attention of the civilians by such inglorious feats as to throw bombs on open towns and kill the women and children.

However, the *avion* is the king of the modern battles. It is with its invaluable help that we have been able to win all our victories. Of course at the beginning we were somewhat surprised—Germany had organized her aerial fleet in such a marvelous and quiet way. The aviators were more numerous than we had supposed. On our side we utilized, without delay, our army of the air, and in a short while it rendered exceptional services to our *état major*. It has played a decisive part in the battle of the Marne, and every day we find it to be an invaluable auxiliary, an indispensable help to the march of our armies. Every day we witness some magnificent and thrilling feats upon the part of the aviators. For instance, the *sang-froid* of this lieutenant whose motor stopped working when he was just reaching the camp of the enemy. He would not fall to his death without having accomplished his mission, and putting his machine to volplane he threw his projectile with perfect accuracy. There is nothing in ancient history which surpasses or even equals such courage. Imagine the cold heroism of this man, sitting up there in the clouds, almost immobile in his darting machine. And this man is able to tell himself quietly: "If I see an *avion* enemy I dash straight upon it." His hand was as steady as his heart and his eye clear, his only care was to make his voluntary death bring the maximum of service to his country.

The hatred which exists between the two fighting armies is ferocious. I cannot keep from my memory the horrible picture which I saw one evening in a village. After having repulsed the enemy we entered one of the abandoned houses. In a narrow corridor I saw two soldiers, one French and the other German; both had pierced each other at the same time with their bayonets. They had met face to face in this dark hall, and with the same action they had impaled each other. Death had taken them there, both standing up imprisoned between the two walls of the narrow passage, united by the thrust that had killed them.

To finish, I wish to relate the story of this brave French officer, who in a sharp fight discovered a Prussian officer hidden behind a locomotive. The two men looked at each other, and with one accord they walked fifteen steps away and took position for a duel. "Shoot," said the Frenchman. The German obeyed, but missed his aim. The Frenchman then lifted his arm, and his adversary fell pierced with a bullet.

I believe sincerely that even our enemy cannot deny the value of the French soldier. Indeed, the fault of our troops is an excess of courage. When riding through the forests our cavalry even refuse to deaden the noise of the horses' hoofs by riding on the grassy side of the road. They sing, they laugh, they gallop.

This war is a war of a new kind, where the events succeed each other with a great unexampled rapidity—it is the effort of whole nations.

Oh! The dash of our men rushing to the fight! The magnificent determination of those who, each day, go to fill up the gaps; the heroism of the families bearing their anguish and mourning their dead.

Those men are the flower of France, who scorn all danger, and who rush toward death for the honor of the flag and of the country.

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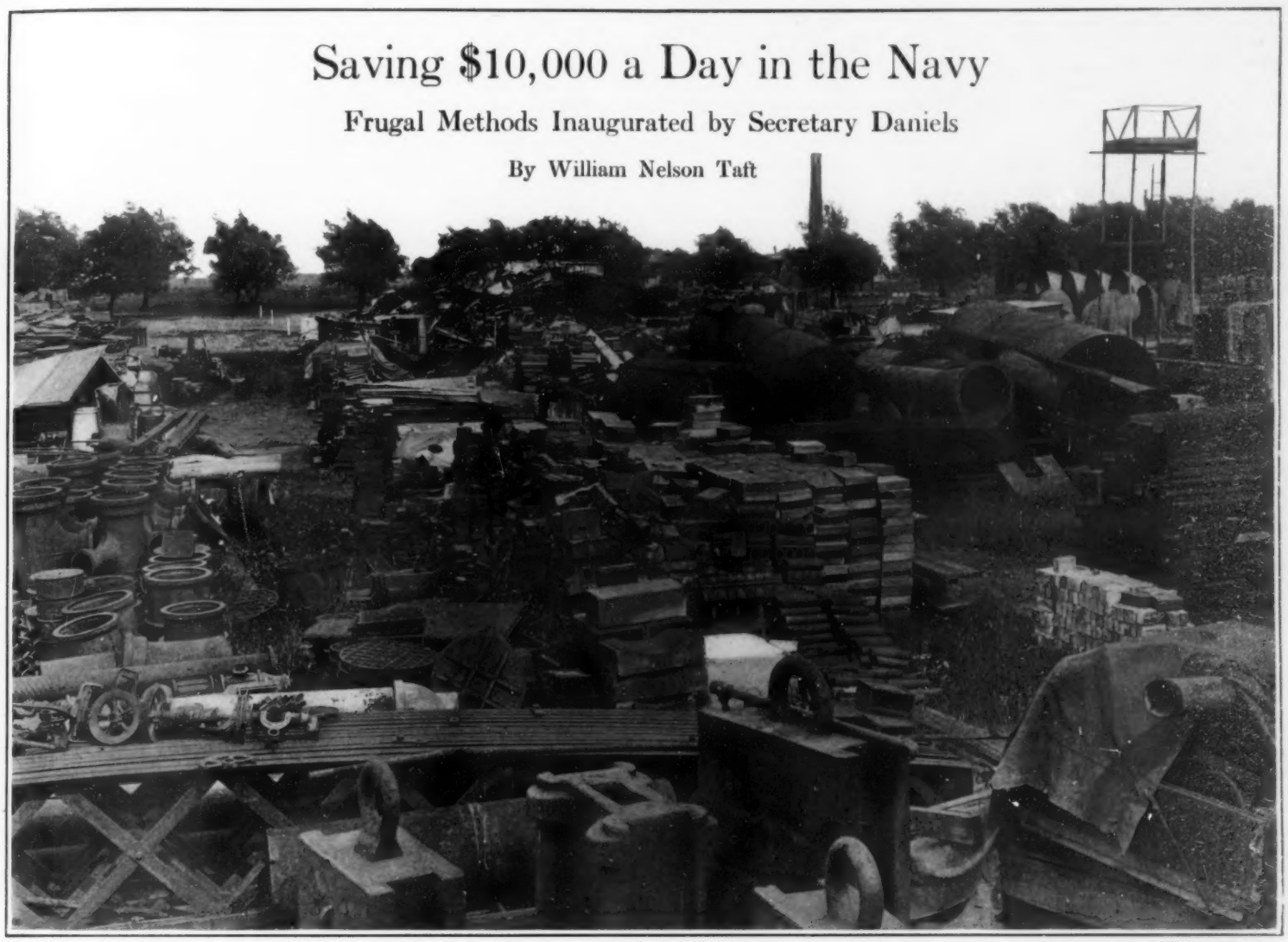
Progress of Agricultural Education in America

DURING the past ten years the number of students taking the full four-year course in agriculture in American agricultural colleges has increased from about 2,500 to 12,500, or 500 per cent. The number of white students registered in short or special courses has doubled in the same period, amounting now to about 11,000. Since 1910 the yearly number of graduates in agriculture has increased from 708 to 1,384, and the number receiving advanced degrees from 74 to 164. The aggregate revenues of the land-grant colleges have about tripled, while those of the experiment stations have more than tripled. The men on the staffs of the experiment stations have increased from about 750 to about 1,600, and the number of those doing no teaching from 375 to 925. An especially notable development of the last decade has been the growth of agricultural instruction in secondary schools. In 1903 very few secondary schools gave such instruction, while at present over 2,000 do so. Remarkable progress is also to be noted in agricultural extension work, outside of that carried on in farmers' institutes. There are now 1,300 men employed as state, district and country agents, and as boys' and girls' club workers. The operations of the Smith-Lever Act will greatly increase this class of work. The above figures are quoted from a recent address by Dr. A. C. True, director of the United States Office of Experiment Stations.

Saving $10,000 a Day in the Navy

Frugal Methods Inaugurated by Secretary Daniels

By William Nelson Taft



Economy in the Navy Department.

How the scrap iron at the Philadelphia Navy Yard is segregated and piled, so as to get the best possible price from purchasers.

BY careful business management and attention to details in administration the Navy Department saved the Government of the United States $3,156,677 in the fiscal year which ended June 30th, 1914. In other words the Department has saved a trifle over $10,000 for each of the 310 working days comprised within the official year! The books of the Navy Department for the first fiscal year of the Daniels administration show the following clear savings:

Projectiles	$1,107,860
Battleship No. 39	795,394
Food, clothing, and other supplies	500,000
Scrap metal (except copper)	300,000
Copper reclaimed	150,000
Requisitions	143,423
Colliers with fleet	75,000
Transportation of men and materials	50,000
Channel at Mare Island, Cal.	35,000
Total	$3,156,677

Government officials have but a single answer for this phenomenal reduction in the running expenses of the Navy Department—"Competition."

Competition was responsible for the cuts in the projectile bids; competition saved the Government nearly $800,000 on the cost of a single battleship; competition reduced the cost of feeding and clothing the men of the Navy by a clean half-million. Competition, in short, saved the Government $10,000 a day!

Shortly after taking office Secretary of the Navy Daniels was convinced that the Government was being mulcted by the bidders for naval supplies. He was not able at the moment to put his finger on the exact spot where the loss occurred, but a little quiet investigation assured him that the so-called "competition" among bidders was nothing more than a farce which the Government paid a good price to witness. In explaining the situation as he found it, the Secretary of the Navy said:

"Theoretically, in conformity with an Act of Congress, the Department advertises generally for bids on armor-plate. Theoretically, the information that the Department wishes a large quantity of armor-plate is spread broadcast the length and breadth of the land in order that every manufacturer may bid. Theoretically, no competitor is allowed to bid who is engaged in any combination to keep up prices. When the bids are received they are opened, and it is, I believe, the general impression that the lowest bidder in what has been an open contest receives the award of the contract.

"Now let us see what was actually done in the case of the contracts for 8,000 tons of armor-plate to be used on the new battleship "Pennsylvania," which will cost the Government in the neighborhood of $3,500,000.

"The advertisement for this contract actually appeared in one notice, an inch long, in the Philadelphia *Item*. The advertisement read 'Sealed proposals for furnishing armor for vessels will be received at the Navy Department at noon, February 18th.' No hint of the amount or quality of plate desired was given and bids were received from three plants—the Carnegie Steel Company, the Midvale Steel Company, and the Bethlehem Steel Company.

"Each of these bids was accompanied by the usual affidavits, required by Act of Congress, that the company submitting the bid was not in combination with any other company, and that there had been no collusion in the determination of the prices named.

"It would be natural to suppose that the lowest bidder would receive the award. But such was not the case. On the theory that all three companies must be encouraged to maintain their armor-plate departments, the contract was arbitrarily divided among them at the price bid by the lowest firm!

"This has long been the established custom of the Department, and can hardly be said to be an inducement to any one of the competing companies to bid the lowest possible price. Under the circumstances, I am surprised at the moderation of the bids, because I do not see that anything but modesty or the fear of a Congressional investigation kept them from putting their lowest price at, say, $700 a ton.

"This practice was not confined to armor-plate, by any means. I have met it in practically every field of contract bids. Probably the most striking instance was when I examined bids for two complete conning towers, submitted by the Midvale and Bethlehem Steel Companies and accompanied by the usual affidavits that the companies were not in any combination. Despite this fact, and the collateral one that they were supposed to have worked on independent sets of figures, the two companies had arrived at precisely the same bid of $43,062!"

It was consideration of these facts that led Secretary Daniels widely to advertise for special treatment steel plates for Battleship 39 (as yet unnamed), and the contract was finally awarded to the Carbon Steel Company of Pittsburgh, which bid for 3,900 tons at $187.04 a ton.

The last previous purchase of similar material was made in December, 1910, when 1,600 tons were bought from the Carnegie Steel Company at $294.03 a ton. The saving on the "Battleship 39" contract, therefore, amounted to $106.99 a ton, or about 36 per cent of the previous price, with a total saving of $378,261.

After advertising for bids on the armor-plate for the same battleship and again receiving three identical estimates, Secretary Daniels requested a conference with the representatives of the three big steel companies "with a view to learning by what process of mental telepathy they had arrived at the identical figures in their bids."

After this conference the Secretary of the Navy said: "The identical bids of the three great steel companies speak more eloquently than any explanations which may be offered. They prove conclusively that 'competition' for this enormous amount of Government business is a farce." The three bids were ordered thrown out and the contract was re-advertised.

Upon receipt of the new figures it was found that the Midvale Steel Company had cut its original price $14 a ton on all classes of armor, and the entire contract was awarded to this company at a saving to the Government of $111,875.

Letting the contract for the turbine rotary drums for "Battleship 39" to the Cyclops Steel and Iron Works of Sheffield, England, saved the Government $102,836 more. The bid of the British firm was only $57,436 as against $169,368 and $160,272 bid by the American companies—a saving of 65 per cent on this single item.

But even greater than all the economy practised with regard to the construction of "Battleship 39" was the saving effected in connection with the award of contracts for projectiles to be used by the Navy during the present year. By enforcing free and open competition with respect to contracts for these shells, the

(Concluded on page 357.)

Strategic Moves of the War

Letter from the Military Correspondent of the Scientific American, October 24th, 1914

The Campaign in France.

THE capture of Antwerp freed for the Germans the army of Gen. von Beseler that had been engaged in this attack, and enabled them to undertake the next step of their campaign. The assaults against the lines of the Allies at Roye, Lassigny, and Rheims had shown that further attacks on the center would have little chance of success. Accordingly, they made their effort on the northern flank, where neither side yet had sufficient troops to occupy continuous fortified lines.

The Germans followed close behind the fleeing Belgians, but seem to have sent part of the Antwerp army to reinforce that of Gen. von Boehm at Lille. In the effort to render aid to the Belgians, the British sent troops from France toward Ostend and were unprepared when the German blow fell. The attack was expected along the coast from Ostend, but the main German advance was made from Lille. The British resistance was overcome and their line was forced back, as given in one report, to a point between Hazebrouck and St. Omer.

The French line held firm at Arras and the British-Belgian force held back the Germans on the east at the Yser River. When reinforcements enabled the British to check the German columns near St. Omer, the latter found themselves threatened on three sides and had to beat a hasty retreat. In following up this move the British recaptured Estaires and Armentieres and forced the Germans back to Lille. This thirty-mile advance and retreat had left the lines with little change in their relative positions.

The great German campaign for the capture of Dunkirk had failed, though, and the Allies had shown their fighting ability under adverse circumstances. The result could not but be of considerable encouragement to them, especially so since the forces in this field were reserves and volunteers whose conduct under fire was until then untested.

The Allies are still fighting, not so much to win, as to keep from getting badly beaten in these first days of the war. Their full strength cannot be developed before next spring, so they are well satisfied with an even break at present. So much have the Prussian successes, against Austria in 1866 and against France in 1870, impressed the military men of all countries that the whole strategy of the Allies has been directed to avoiding a knockout blow in the first rounds. If they can force the combat to settle down to a question of endurance, there can be but one outcome. In the beginning Germany's well-trained and well-equipped men can outfight largely superior numbers of their opponents. But before August comes again the Allies will be able to outclass them not only in numbers, but also in armament, ammunition, and the accessories that add so largely to the fighting power of troops.

By the addition of the small remainder of the Belgian army and by the arrival of a new volunteer army from England the Allies have been able to strengthen their northern flank. Their entrenched line now extends to the North Sea near Nieuport at the mouth of the Lys River. For 300 miles, from the coast to the Vosges Mountains at St. Die, the two forces oppose each other along lines strengthened by firing trenches, bombproof shelters, redoubts, and every form of earthwork. Any frontal assaults will be driven back with enormous loss unless the fire of the defenders can be prevented. Yet these are the tactics that are apparently going to determine the outcome of the great battle in France.

The main weight of the German attacks has fallen in two places. In the north their move against Dunkirk seems to have been defeated, but in the south their attacks on the forts of the Meuse continue with increased energy. The French claim that these have been repulsed, but the success of the Germans in maintaining their advanced position at St. Mihiel indicates that they have achieved some other successes in this region.

Meanwhile the French are making a slow advance from the south that is bringing the German line into a dangerous position. By occupying Apremont, due east of St. Mihiel, and Pagny, farther to the east on the Moselle River, the French have advanced to within ten miles of the German line of communications. This ten miles, though, includes the barrier of the German entrenched line; much hard fighting will be required before the supremacy in this field is settled.

Tactics of Frontal Assaults.

This is the first war in the world's history in which assaults on entrenched positions have had to be carried out over such a frontage, and the necessity of such tactics has largely increased the importance of artillery. So great has been the improvement in this arm that a battery can put out of action any troops in open ground on which it can deliver fire. The defense against this arm must come either from concealment or from silencing the enemy's fire.

When an attack against the enemy's line is planned every preparation must be made before the troops are moved. By aerial reconnaissance the hostile artillery and the dispositions of the enemy's forces are located. Then the troops for the assaulting columns and the guns for their support are moved by night to positions opposite the point of attack. Every provision must be made to conceal the move from the enemy's scouts and to keep the new troops under cover all of the succeeding day.

Meanwhile the officers reconnoiter the fields over which they are to make the advance. During the succeeding night the assaulting columns move to their positions and the guns are trained, some on the enemy's artillery and some on the infantry trenches. The columns then start the advance. At the first sign of discovery by the enemy of the approaching attack the artillery lets loose its storm of shrapnel in the effort to cripple the opposing guns and to force the hostile infantry to keep under shelter. Under this protection the infantry advances until the leading line is within 400 yards, a quarter of a mile, of the trenches.

Their own field guns must then change their fire to some target other than the trenches for fear of shooting up their own men. The assailants consequently are dependent upon their own efforts for the further prosecution of their attack, and to accomplish this it is essential that the opponents be prevented from delivering an unopposed rifle fire. This is accomplished by allowing only half of the charging line to advance at a time. While one half keeps up the rifle fire that keeps the enemy from manning his parapets in full force, the other half rises and rushes forward thirty to fifty yards. In this way by successive partial advances by rushes, the line is worked up close to the enemy's trenches. But here the wire entanglements and other obstacles are encountered, and costly delay ensues while they are being removed. This accomplished, the line moves forward again until the enemy's defenses are reached, and the question is settled by hand to hand fighting with the bayonet.

More often the assault is checked before it reaches its object. Then the men take advantage of any slight depression and dig for all that they are worth. Twenty minutes' work will give them protection from rifle fire, while an hour's digging will give a deep narrow trench furnishing shelter from shrapnel fire. In this case the trenchwork is continued throughout the night, and also during the succeeding days until the advanced position thus gained is strongly defended.

In case the ground gained cannot be held the retreat is carried out similarly to the advance, one half firing while the other retires. The artillery in this case also renders valuable service in protecting its own side from the great losses that they would suffer if subjected to the unencumbered fire of the enemy's field guns.

The Russian Campaign.

In the campaign in Russia the fighting along the East Prussian boundary has come almost to a standstill during the week. The Russian attacks pushed the Germans back to Lyck in Prussia and Wirballen in Russia, but here the German defense stiffened and has held the Russians back. It is probable that the Russian attacks have also been weakened by the necessity of rushing troops to the south for the defense of Warsaw.

In the campaign in Poland the Germans accomplished their two great strategic objects of relieving pressure on the sorely-tried Austrian forces and of carrying the war into the enemy's country. The momentum of their advance carried them up to the gates of Warsaw. Repulsed here, they recoiled upon their forces to the rear just as a stretched rubber band will draw back to normal shape.

This is a quality of military operations as of many other forms of activity. An aggressive policy adds the energy of motion to the inherent strength, or potential energy, of the actual numbers. The Commentaries of Napoleon aptly express this in the words, "The strength of an army, like power in mechanics, is estimated by multiplying the mass by the rapidity; a rapid march augments the *morale* of an army, and increases all the chances of victory." But if the active move be checked this advantage passes and the ordinary factors of numbers, equipment, and training determine the superiority.

The recoil from the attack on Warsaw has carried the Germans back thirty miles, but in the south they have maintained their advanced position and are disputing with the Russians the possession of the crossings of the Vistula River in its upper stretches near the Galician border. This is where they join with the Austrians, and it is by attacks in combined strength on this part of the Russian line that they hope to break through and to force the further retirement of the Russian forces in Galicia.

The Austrians have followed closely behind the retreating Russians and have shown an energy that gives proof of the important gain secured by the German cooperation. By the reverses in the north the Russians have been forced to call in their cavalry divisions from Hungary and to concentrate every effort on holding the positions along the Vistula and San rivers while waiting for further reinforcements to reach the front.

In the control, supply, and reinforcement of their lines the Russians have a considerable advantage. In their rear they have the five undamaged railways in Russia and the three repaired lines in Galicia. Both the Germans and Austrians have advanced over districts in which the railways have been recently destroyed. They cannot yet be fully repaired, while the continual rains make the country roads almost impassable. Russian mud bids fair to defeat the German invasion, as it did that of its noted predecessor, the great campaign of Napoleon against Moscow in 1812.

Rasmussen's Exploration in Northern Greenland

DETAILS of the remarkable crossing of Greenland by Knud Rasmussen and P. Freuchen in 1912 have been slow in reaching the world, but it has been evident since the first announcement of this feat that it was in many ways unique in the history of polar exploration. The explorers left the Eskimo trading-station "Thule," near Cape York, April 5th, 1912, for the eastern coast. On the outward journey they sledged 650 miles over the inland ice in 165½ hours, while on the return journey a distance of 530 miles was covered in 175½ hours. Of the fifty-four dogs with which the travelers started, twenty were brought back. It is now learned that another somewhat similar expedition was carried out in 1913, and that the station "Thule" is henceforth to be the base of extensive explorations in northern Greenland, thanks to funds provided for this purpose by a Danish manufacturer named Olsson. It is also reported that Rasmussen will undertake a north polar expedition next summer. In co-operation with the geologist of the American Crocker Land Expedition, which has its base in Etah, Greenland, Rasmussen recently made a study of an immense iron meteorite, found at Cape Melville by Eskimos, and has taken steps to have it transported to Copenhagen.

The Current Supplement

ON the front page of the current SCIENTIFIC AMERICAN SUPPLEMENT, No. 2026, for October 31st, is a striking picture of one of the great salmon which are caught in such immense numbers on the west coast of our continent. Comparatively few people realize the magnitude of the salmon canning industry, and the story that accompanies this illustration will be new to readers in many parts of the country. Who knows what life is? This is a question that is being asked by scientists, and their investigations and discussions are interesting the world. The article on the Principles of Biochemistry is a contribution in this direction. The Value of Radium in Surgery is a statement by a leading surgeon of actual results, a sane, authoritative valuation without a trace of visionary sensationalism, and an informative article that will be appreciated by all. The Nodon Electrical Process for the Preservation of Wood is something that should vitally interest every user of that material, as it describes what is claimed to be a perfect process, that can be worked rapidly and cheaply. The valuable article on the Metallurgy of Iron is concluded, as is also the interesting description of the application of the Gyroscope to do the work of the compass, and other wonderful applications. There is also in this issue a wide assortment of articles to meet the taste and interest of all classes of readers.

A Woman Explorer in Arabia

A DARING exploit carried out early this year was Miss Gertrude Lowthian Bell's journey from Damascus to Haïl, the Shammar capital, in the heart of Arabia, a place which had not previously been visited by any European since Baron Nolde was there in 1893. From Haïl Miss Bell traveled north to Bagdad, and thence across the Syrian desert back to Damascus, after a journey of four and one half months. The principal investigations carried on during the journey were archæological. Miss Bell will describe her experiences before the Royal Geographical Society, in London, December 7th.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Cost of Establishing an Aniline Dyestuff Industry

To the Editor of the SCIENTIFIC AMERICAN:

The quotation of a statement made by Dr. Hesse, which is given on page 302 of your issue of October 10th, in an article on "Coal Tar Dyes," contains a somewhat misleading misprint. The initial outlay involved in the establishment of an aniline dyestuff industry, is estimated, on Dr. Hesse's authority, at $50,000,000. As a matter of fact, Dr. Hesse's statement published in *Metallurgical and Chemical Engineering* is that the initial lump gross outlay for this purpose would be not less than $5,000,000 actual cash. ALFRED J. LOTKA,

New York. General Chemical Company.

Scarcity of Potash Salts.

To the Editor of the SCIENTIFIC AMERICAN:

Noting the statements made concerning the scarcity of potash salts in this country owing to the cutting off of the supply from Germany, I wish to call attention to the possibility of a small supply in connection with our beet sugar industry.

In European countries the so-called "vinasse" from the stills used in treating beet-sugar molasses is treated in such a way as to obtain about ten pounds of crude potash salts to the one hundred pounds of molasses entering the still. These crude materials average from 40 to 70 per cent of potash salts.

It would seem that if the price of potash continues to rise, the production of potash salts from the beet sugar refuse in this country might be profitably carried on. W. B. HARPER.

Montgomery, Ala.

Interesting Shop Kinks

To the Editor of the SCIENTIFIC AMERICAN:

The following might be good to know by many of the readers of your journal.

Among my jobs as machinist once was one of repairing a leaky boiler. In the boiler were about 700 copper flues of ½ inch diameter. After having spent about four successless hours in order to get out one of the flues that had to be replaced with a new one, to me came the idea of threading one end of the flue with a tap, large enough to make a sufficient hold for a bolt or screw, but not so large as to cut through the copper flue. When I had the bolt or screw in the one end of the flue, I unloosened the other end of the flue, put a steel rod through the flue, hit the rod with a hammer, and it took only about a minute to get each of the other faulty flues out of the boiler in my new way of doing it.

Once I was reaming out a new wristpin lining for an air compressor. The reamer was 2½ inches in diameter, but it was just a trifle too small for making the bore in the lining large enough, so I took a strip of thin copper, such as are used as fuses connected with cables or bars, transmitting electric currents. First I used a strip of the copper, wide enough to cover three of the teeths of the reamer, and let it follow the reamer through the bore, but still the hole was too small. After using another copper strip, covering four of the reamer's teeth, I got a perfect fit for the wristpin.

New York. G. H. ANDER.

Our Foreign Possibilities

To the Editor of the SCIENTIFIC AMERICAN:

There are many things to be done before the United States can permanently secure a foothold in foreign markets. Some of these things have been done. Through the aid of the National Foreign Trade Council our shipping laws have been revised, so that it is economically possible to operate ships under the American flag. The bars which have obstructed American shipping are not yet entirely removed, but we have made great progress. National insurance of the hull and cargo is now an accomplished fact. Next, and of the greatest importance, is that the Sherman Law should be so amended as to exempt export trade. This law was framed, and is enforced, to protect and care for the welfare of American people. The intent of the law is plainly in the interests of the small manufacturer, yet as applied to export trade it seriously interferes with the small manufacturers' opportunity, and nobody wants to pursue any policy in business to-day where there is even a suspicion of infringement of the Sherman Law.

The one sure way to develop export trade is to send the best men into foreign countries. Those men should be equipped with a knowledge of the subject and with the lowest prices at which the goods can be sold. It is beating the air to try to get our full measure of foreign business through agents, through catalogues, or through correspondence. The value of the business depends upon the value of the man sent to get it, and here is where the small manufacturer is placed at a disadvantage. He cannot afford it, yet the Sherman Law is supposed to be his helper.

Combinations of manufacturers are permitted in most of the large foreign countries. They get together and are even patronized by the Government in their efforts to sell goods abroad. Place the American manufacturers in the same position, or in a position even approaching it, and they will establish themselves.

Foreigners in general look upon America as the most advanced of all countries, the home of inventions, and their ears are open when approached by competent experts who know their business. Good men will see to it that the foreigner is asked to buy from us, and at the same time he should be asked what he has to sell the American manufacturer, because through reciprocative trade the foreigner will be able to pay his bills.

The next important point is to establish banking facilities by means of which goods purchased in foreign countries may be paid for by drafts on New York or other American banks. All other conditions are those that are common to any business house seeking business anywhere in the world. W. L. SAUNDERS,

New York. Ingersoll-Rand Company.

Violation of Neutrality Foretold

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of the 12th of September you stated in your editorial the following: " . . . Nothing that Count von Bernstorff or any other apologist of the German breach of good faith may say, can make the American people think that Germany believed France was intending to do that which she herself has done (i. e., violated the neutrality of Belgium)."

On page 148 of John L. Stoddard's Lectures (1898) on Belgium, I accidentally came cross the following the other day:

"It is well understood that this neutrality has been guaranteed by England, France, Russia, Prussia, and Austria; yet from a military standpoint, it is also clear that the powerful armies likely to be organized upon its borders, in case of war, would be compelled to enter in order to secure a position in which to attack each other. . . . Still, notwithstanding the well-known views of England on this subject, and the policy she would be likely to pursue to maintain Belgian neutrality, I recently heard a distinguished European diplomat (German?) say that if war should break out between France and Germany, the neutrality of neither Belgium nor Switzerland would be respected by either of the contending forces; that the violation of neutral rights would be absolutely required by the necessities of the situation; and that the contending armies would undoubtedly be obliged to pass through one or both of the neutral countries, or possibly even to fight on their soil, and Switzerland is fortunate through intervention of Italy."

Even in this far-off integral portion of Uncle Sam we are taking a lively interest in the outcome of this gigantic war, and ere this will reach you, probably in two weeks' time, it is sincerely hoped that Uncle Sam would be successful in arranging for peace, so that the millions of young men now on the battle field, in the armies of each of the powerful contending powers, may be spared the awful doom awaiting them all should this war continue for a year, or even months.

KAOAOKALANI.

Wailuku, Maui County, Ter. Hawaii.

The Revocation of Patents Owned by Belligerents

To the Editor of the SCIENTIFIC AMERICAN:

London cables have informed us lately that England has instituted a boycott against anything made in Germany and that England had declared war against Germany because it had guaranteed the autonomy of Belgium. Inasmuch as the understanding of both Triple Alliance and Triple Entente stipulates that if one of the three was invaded by a foreign foe, the other two should come to its assistance, so England was in the same position as Italy, and if both of those countries had remained neutral, a great deal of the present carnage in Europe would have been avoided.

If England had joined with Germany, as requested, to induce France to remain also neutral, it is more than likely that there would have been no war at all. England's claim that its honor required that it go to war because it had guaranteed Belgian autonomy, is a subterfuge viewed by her past. Simply by the law of force on account of its largest navy, she took Egypt, the Transvaal, Orange Free State, Gibraltar, Cyprus, and India; then she bombarded Alexandria in 1882 and Copenhagen in 1807. Her guarantee did not bother her when she canceled thousands of her guarantees in canceling German and Austrian patents. Belgium was guaranteed by Germany full autonomy; was told that Germany only asked for passage, and Belgium had already allowed French aeroplanes to reach the German border for reconnaissance, and military aeroplanes are as much instruments of war as are cannon.

England, Japan, and the United States have guaranteed the autonomy of China. The Japs are landing, daily, troops in China, and it appears that England offers no protest. In my opinion, the cancellation by England of the many thousands of German and Austrian patents, after the inventors had fully disclosed their inventions to England in good faith, is the crime of the age against the genius of a great people.

Notices in the press would indicate that France, and even Canada, expect to follow England's suit and declare German patents invalid, and in my opinion your most influential publication should vigorously oppose such procedures. Inventions are for the benefit of mankind in general, not for any one single country. If an invention pertaining to instruments of war were canceled, there might be some excuse for that, but not for the cancellation of all patents, and each patent issued by any government implies the guarantee by that government, in return for the disclosure of the invention, the full protection and guarantee of the issuing government. WILLIAM EDENBORN.

New Orleans, La.

Technical Writing by Non-technical Men

To the Editor of the SCIENTIFIC AMERICAN:

Perhaps a few additional facts may clear up the much discussed question of non-technical writings.

Incorrect pen pictures, artistic or otherwise, distribute false impressions; they may even be harmful, as the widely taught accounts of Mahomet's coffin (said to be magnetically suspended in space!)

No artist's work, on the other hand, is the less valuable for a close adherence to facts. One of the best popular literary accounts of an engineering feat, "The Story of a Lighthouse" (Smeaton's) was written by a trained *engineer*, Dr. Du Bois of the Sheffield Scientific School. The notion entertained, and so often sarcastically mentioned, by certain academic "highbrows," that an engineer is synonymous with grime and grease and lack of artistic appreciation, lacks the support of facts. The very engineer who endures the dust and pressure of the task is the one who endeavors to surround his home life with the best that civilization offers.

Whatever may be the excuse offered for inaccurate accounts of engineering work, the real reason appears to be the laziness of the writer; this statement is, of course, not personal. As a result we have the Sunday supplement space fillers, for the newspaper writer seldom has the time for careful inquiry. Instead of associating with the workers or becoming partially familiar with the applied viewpoint, the natural and easier course has been to slur over vague points with the nice phrase and terms which are so plentiful—"Aerial principles governing" to "Zero of the thermometer kind of heat." One reason why we have bulky text books is the "in other words" repetition used by the confused authors to cover up their own deficiencies. Accuracy does not, however, require technical terms and extreme formulation. "Catalysts" means nothing to the average reader. "A contact body which controls a chemical action but is not itself consumed" is better, because it means just what it says. Formulation is all right in a mathematical exposition of "Electric Waves," but when applied to ordinary technical subjects, only results in needless confusion, and referring back to or memory of the whole sentences represented by a single word or symbol. Fortunately, some recent attempts at coining new technical words to cover a whole statement have been distinctly frowned upon, as "jigger" in radio-communication. "Ohm's law gone to seed" may not sound technical, but is the expression used by Prof. W. S. Franklin (Lehigh) to startle a body of physics instructors into a realization of the vague explanations still existing in certain text books.

We see, then, that it is not at all a question of who does the writing, for while one technical man makes a muss of one subject, another writer, without technical training, turns out a lucid account of the same matter, or *vice versa*, the man of grease and grime produces the literary as well as the actual masterpieces, while the professional writer goes astray in a mass of fine massages.

Finally, when we consider the mass of effort expended on the well worn, common literary topics, the relatively minor attention directed to technical and industrial achievements is surprising. Compare the few pages which deal with scientific progress, in school books, for instance, with the hundreds of pages devoted to the minor political occurrences of past ages, and you will see that encouragement should be given to every writer, regardless of his technical or non-technical antecedents, who really has something to say about the achievements and improving forces of the world. Common steel and cement, despised sewage, unsensed vibrations—such are the points which may yet form greater masterpieces than were ever made from human blood!

Minneapolis, Minn. PHILIP E. EDELMAN.

The Colin-Jeance System of Wireless Telephony

New Apparatus With Which Telephonic Communication Has Been Carried On Over Sixty Miles

By Jacques Boyer

WIRELESS telephony, one of the most remarkable applications of electricity, is the transmission of sounds or spoken words to a distance by means of a microphone at one station and a telephonic receiver at the other, the two instruments being connected, not by a wire, but only by trains of aerial electric waves.

As the tones of the human voice and those of musical instruments involve thousands of vibrations per second, the electric waves employed in wireless telephony must be sustained and of great frequency (80,000 to 100,000 per second) in order to assure uninterrupted transmission, as Blondel has shown. Several experimenters have accomplished this result, by two general methods. In the method first employed high-frequency alternators or rapidly rotating static induction machines were used. In order to evade certain practical difficulties Poulsen employed the singing arc. This is an electric arc, produced by a direct current dynamo, in the circuit of which inductance coils and a condenser are intercalated. The arc is formed, not in the open air, but in a conducting atmosphere composed of hydrogen and hydrocarbons, similar to illuminating gas. In these conditions electric oscillations, which may number 500,000 per second, are produced in the arc. If the singing arc is employed to excite an antenna indirectly, by induction, the antenna emits sustained waves of great frequency, which are very suitable for the transmission of musical tones and spoken words.

A microphone inserted in the circuit of the antenna impresses the necessary modifications upon the emitted waves, and the sounds are reproduced by a telephone connected with the antenna of the distant station.

A few years ago Capt. Colin and Lieut. Jeance of the French navy made some experiments in wireless telephony between the Eiffel tower and Villejuif, 5 miles distant; then between a warship and a land station 12 miles apart; and finally between two land stations separated by a distance of 62 miles. After these modest beginnings the electricians of the Compagnie Générale Radiotélégraphique, which had constructed the apparatus used by Colin and Jeance made improvements, particularly in the microphone, which had been found unable to sustain very strong currents.

Successful telephonic communication has recently been made between Paris and Voves, a distance of about 62 miles, with the new apparatus, which is briefly described below.

The arc is formed in an atmosphere composed of hydrogen and acetylene, the former obtained from hydrolith (calcium hydride) and the latter from calcium carbide. The two gases are evolved in the same generator, where they are induced to unite by vigorous stirring. The carbureted hydrogen which results from their union passes, at a little more than atmospheric pressure, into a cylinder 6 inches in height and 16 inches in diameter. Three electric arcs, occupying the vertices of an equilateral triangle and connected in series, are placed inside the cylinder, which has two lateral openings. One of these openings is covered with red glass and serves as a window through which the arcs may be observed. The other opening is covered with parchment, which serves as a safety valve, and is ruptural in case of an explosion due to the accidental admission of air, which forms an explosive mixture with the other gases.

Each arc is formed between a fixed disk of copper and a rod of carbon 1/25 inch in diameter, so mounted that it can be raised or lowered from the outside by turning a crank. The arcs are established by raising the carbons into contact with the copper disk. The carbons are then lowered sufficiently to produce arcs about 1/25 inch long. Although the carbon rods, which form the positive electrodes, are gradually consumed, they need no regulators because their waste is compensated by a deposit of carbon produced by the decomposition of the surrounding gas.

It is necessary, however, to cool the copper disk by a current of water. Each disk forms the bottom of a vertical cylinder filled with petroleum oil and containing a worm through which a steady flow of water is maintained. The water cools the oil, which in turn cools the copper disk. When the part of the disk at which the arc is formed becomes burned it is only necessary to turn the disk slightly by hand in order to present a fresh surface to the electric current. In this way a remarkable constancy of the arcs is obtained.

Three arcs are used because the required voltage ($3 \times 110 = 330$) can conveniently be obtained from a feed current varying from 500 to 700 volts, by interposing an adjustable resistance. There is no advantage in increasing the number of arcs and, consequently, the voltage, because the microphone is injured by sparking if the current through it exceeds 0.6 ampere.

The arcs are included in the circuit of a 700-volt dynamo, together with a pair of choking coils which protect the dynamo from high frequency currents, and a variable resistance which prevents short-circuiting and assures the constancy of the arcs.

This circuit, the oscillating circuit, also includes a variable condenser, and the primary coil of an adjustable transformer. The secondary coil of this transformer is not connected directly to the antenna, but forms part of an intermediate circuit, called the filtering circuit, which greatly increases the range, destroys parasitic waves and supplies the antenna with waves of a single and perfectly uniform length.

This transformer, or inductive coupling, is composed of two flat spirals of copper ribbon mounted in frames. One of these frames is fixed, while the other is hinged like a shutter, so that the angle between the planes of the spirals can be regulated easily and quickly. The filtering circuit is coupled with the antenna in a precisely similar manner, and is completed by the intercalation of a variable condenser. The antenna circuit—radiating circuit—includes a condenser and a variable inductance coil, in addition to the resonator, or spiral by which it is coupled with the filtering circuit.

The microphone is composed of nineteen microphone cells, each formed of pulverized carbon pressed by a thin plate of carbon. The cells are arranged on a circular disk, as may be seen in one of the illustrations, and are covered by the mouth of the megaphone which is shown detached in the illustration. One of the turns of the resonator is connected to earth through the microphone. This arrangement eliminates the sputtering noises that are heard when the microphone is inserted directly in the antenna circuit, and removes the limitation to the energy supplied to the antenna.

Our frontispiece is a view of the interior of the station, and on the opposite page is a photograph of the operator's table separately. This table is furnished with two microphones and their megaphones, which are used alternately for short periods in order to prevent overheating. The change is made simply and quickly by means of a commutator.

Any receiving circuit can be used, with the aid of the tuning spirals which are seen in the cabinet adjoining the switchboard, on another of the photographs.

In the experiments recently made at the laboratory of the Compagnie Générale Radiotélégraphique, waves from 900 to 1,100 meters in length were employed for transmission. Trumpet calls can be produced at the receiving station, with the aid of a keyboard connected with the oscillating circuit of the sending station.

The Italian scientists, Majorona and Vanni, are endeavoring to increase the range of wireless telephony by utilizing the vibrations of liquid veins. Other pioneers are working in the field, and we may expect to be able, one of these days, to telephone from Paris to New York.

Random Reflections

By "Irresponsible"

OLIVER HEAVISIDE, that great but comparatively little known mathematical genius, has an amusing passage in his "Electro-magnetic Theory," in which he discusses the various names which have been bestowed on the scientific man. "Physicist" he rejects with scorn, and indeed there is something barbarous and journalistic about the sound which renders everyone possessed of a musical ear extremely reluctant to adopt it. "Natural Philosopher" he thinks a very fine name, and remarks that it calls up impressive visions of bald-headed old gentlemen, very much wrapped up about the throat. But, he goes on to say, how can one be a natural philosopher with a Salvation Army band performing joyously, if not most melodiously, just outside the window?

This sense of incongruity between the old-fashioned dignified names of the past and our present hustling, materialistic age must have struck more people than Oliver Heaviside. How is it possible to call Prof. Blatant, that celebrated publicist and diner-out, a natural philosopher? Scientist, or even "expert scientist" is the least we can call him. And those gentlemen of truly encyclopaedic knowledge who write so informatively on "Eating Oysters to Prolong Life," "Should Toe-nails Grow Inward," and "Your Character From the Number of Hairs in Your Eye-lashes"—are they natural philosophers? Great are the powers of advertisement.

It is true that we have men living who could carry with dignity the most high-sounding name we choose to bestow upon them. In every corner of the earth where science is pursued the names of these men are known. But what is their fame compared to that of a notorious politician or of a dexterous and indefatigable packer of pork? Henri Poincaré, perhaps the greatest mathematician that ever lived, received, on his death, a few lines lurking in obscure corners of our widely circulated newspapers. But what boots it? He did his work, noble work worthily done, and he left the world the better for his efforts. It cannot matter to such men that the loudness of one's talk impresses the public more than the matter of it; that the man with the most noise obtains a greater hearing than the man of most sense. But it matters to the public. It is time we learnt to distinguish brains from blather.

It is a favorite occupation of mine to read the works of scientific men of the past few centuries. Their results, so far as they are accurate, are in every textbook, and their theories, their ingenious, imaginative, and ofttimes amusing theories, are largely exploded. But what a sweet fragrance and gentle dignity there is about these old books! Take Newton, for instance, discussing the "Propagation of Light." He imagines light to be due to little particles shot out from bodies, and after describing this he goes on, "But they that like not this, may suppose light any other corporeal emanation, or any impulse or motion of any other medium or æthereal spirit diffused through the main body of æther, or what else they can imagine proper for this purpose. To avoid dispute, and make this hypothesis general, let every man here take his fancy; only whatever light be, I suppose it consists of rays differing from one another in contingent circumstances, as bigness, form, or vigor."

Could anything be freer from the spirit of partisanship or more delightfully tolerant? There is a charm about this way of writing which is lost in our modern treatises of deadly rigor.

It would not be difficult to defend the reading of these old books as against the reading of modern treatises. The science you would learn would be all wrong, but what does that matter? I am assuming you are not a professional scientific man. The mental training to be derived from observation and deduction and the rest of the long names which are supposed to constitute scientific method, would be the same. As a matter of fact, the mental training, to say nothing of the mental delight, obtainable from the old books is certainly greater than that which can be got from the modern reasonably elementary treatise. There is no contemplative atmosphere about the modern book. It has a bright superficial efficiency, like cheap woodwork grained and varnished. And they pretend to know everything, these smart, ill-paid young men who churn out elementary text-books. They have none of the humanity, the modesty, the hesitation, the large-minded doubts of a Newton.

I am not referring to modern research work because I am supposing you lack the training to read that at first hand. You want your science to interest and to exercise your speculative faculties in an agreeable manner. Then take my advice and read the old books.

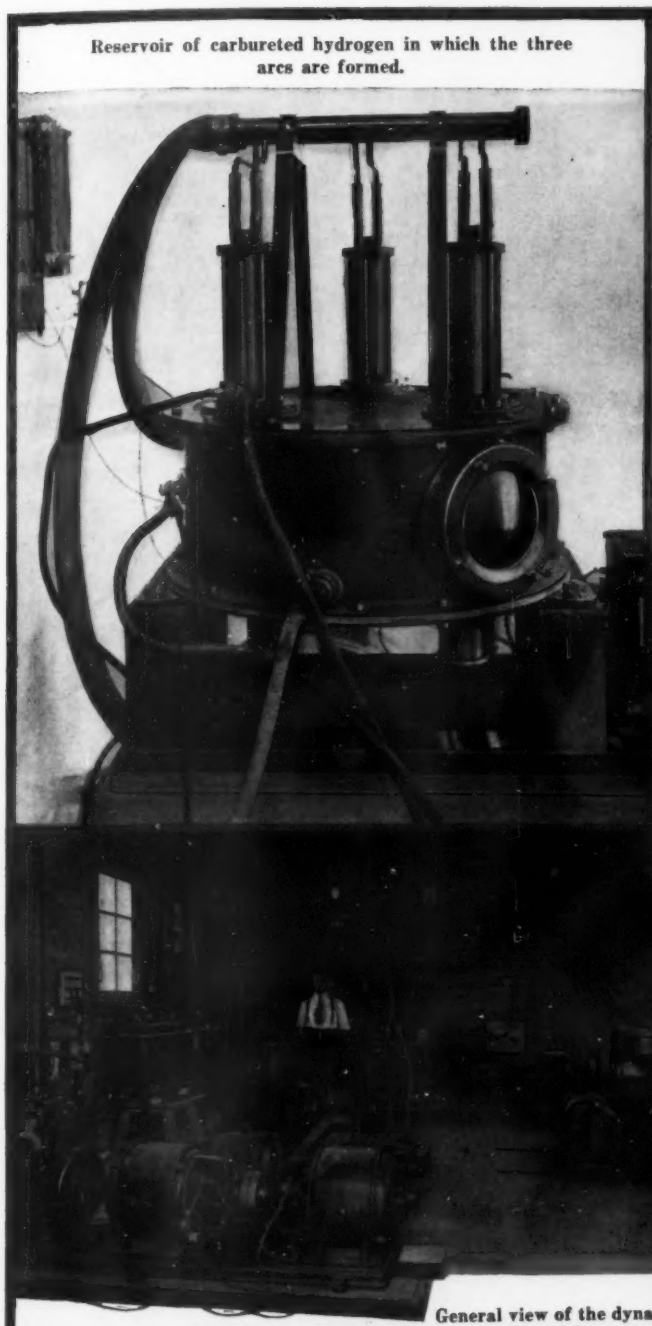
Analysis of Descent

PROF. WILLIAM BATESON, in his address on heredity before the British Society for the Advancement of Science, recalled the fact that the Mendelian theory was the first analytical study of the subject, and before this no orderly system of descent had been suspected. What he has to say about "blood," as the word is colloquially used, is particularly interesting.

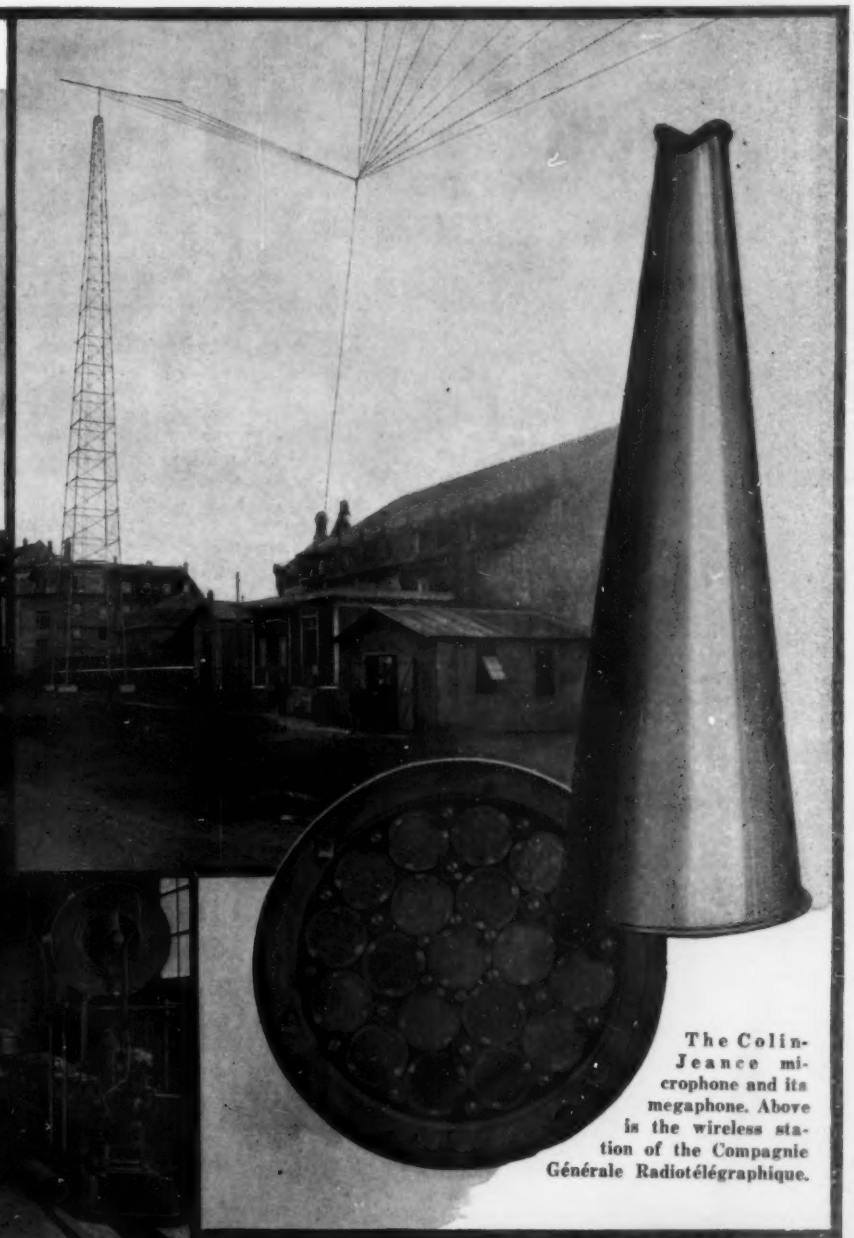
"Misconception was especially brought in by describing descent in terms of 'blood.' The common speech uses expressions such as consanguinity, pure-blooded, half-blooded, and the like, which call up a misleading picture to the mind. Blood is in some respects a fluid, and thus it is supposed that this fluid can be both quantitatively and qualitatively diluted with other bloods, just as treacle can be diluted with water. Blood in primitive physiology being the peculiar vehicle of life, at once its essence and its corporeal abode, these ideas of dilution and compounding of characters in the commingling of bloods inevitably suggest that the ingredients of the mixture once combined are inseparable, that they can be brought together in any relative amounts, and in short that in heredity we are concerned mainly with a quantitative problem. Truer notions of genetic physiology are given by the Hebrew

expression 'seed.' If we speak of a man as 'of the blood-royal' we think at once of plebeian dilution, and we wonder how much of the royal fluid is likely to be 'in his veins'; but if we say he is 'of the seed of Abraham' we feel something of the permanence and indestructibility of that germ which can be divided and scattered among all nations, but remains recognizable in type and characteristics after 4,000 years."

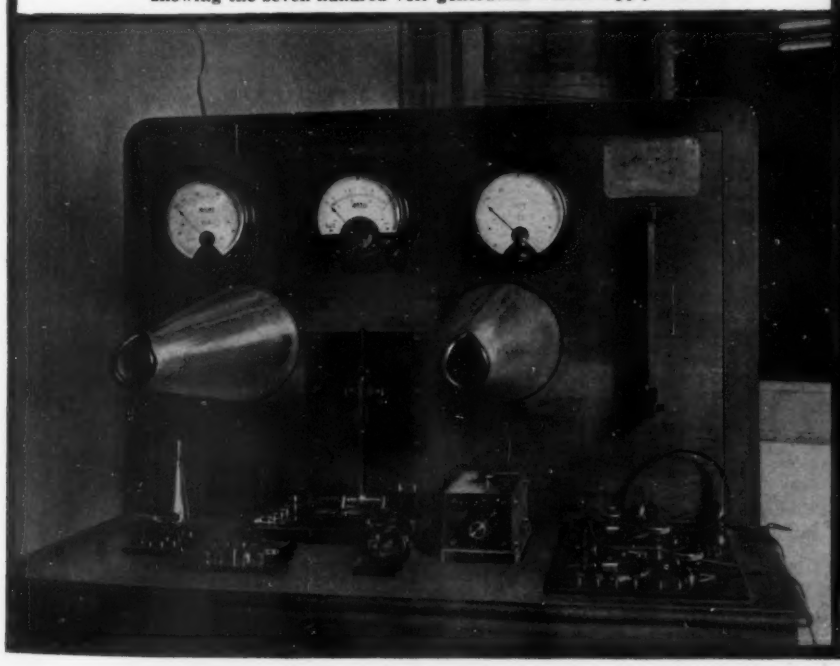
Novel Reinforcement for Automobile Tire.—Patent No. 1,107,672, to Clifford F. Kernen, of Cincinnati, Ohio, for an automobile tire combines reinforcing and non-skid features in a tire by embedding in the surface thereof a fabric of wire cables formed by interlooping strands from the adjacent circumferentially extending cables.



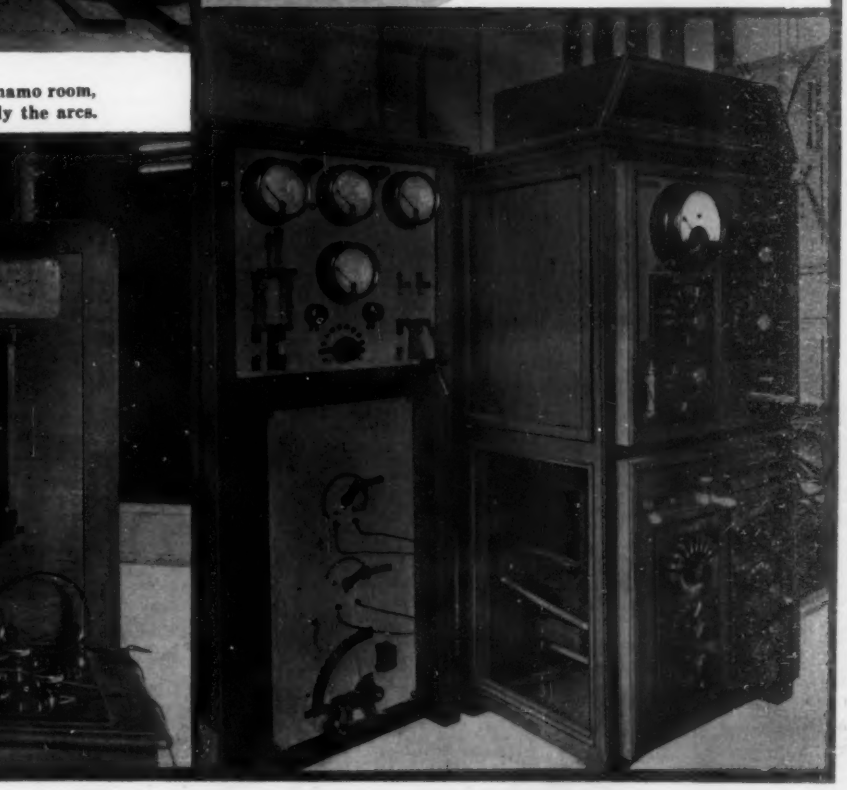
Reservoir of carbureted hydrogen in which the three arcs are formed.



The Colin-Jeance microphone and its megaphone. Above is the wireless station of the Compagnie Générale Radiotélégraphique.



General view of the dynamo room, showing the seven hundred volt generators which supply the arcs.



Operator's table with two microphones and megaphones.

Switchboard and cabinet containing tuning spirals.

THE COLIN-JEANCE SYSTEM OF WIRELESS TELEPHONY

The Heavens in November

Transit of Mercury Across the Face of the Sun

By Henry Norris Russell, Ph.D.

THE present month is noteworthy for a decidedly unusual astronomical occurrence—the transit of Mercury across the Sun's disk, which happens on the morning of the 7th.

If the orbit of this innermost member of our system were in the same plane as that of the Earth, these transits would occur three times a year; but its plane is so much inclined (7 degrees) to that in which we move that at the great majority of conjunctions Mercury appears to pass north or south of the Sun, at a distance which is sometimes nearly 5 degrees, and almost always great enough to carry the planet clear of the Sun's disk.

If, however, Mercury passes one of the nodes of the orbit (that is, one of the two opposite points at which, as seen from the Sun, its track would appear to pass in front of that of the Earth) within some eighteen hours of the time when it passes between the Earth and Sun, it will at this latter moment be actually in line between the other two bodies, and, as seen from the Earth, will appear to transit across the Sun's disk.

The Earth passes the points of its orbit which are in question upon the 8th of May and 10th of November, so that the transits always occur very near these dates (between May 5th and May 10th, or November 5th and November 14th). The May transits are only about half as numerous, in the long run, as those in November, because Mercury is much nearer the Earth in the first case than the second. In consequence, for the same real distance in miles above or below the line of sight from the Earth, it appears to be at a greater angle north or south of the ecliptic in May than in November, and has a better chance of missing the Sun's disk.

Transits of Mercury recur in cycles of 46 years. During this interval, Mercury completes almost exactly 191 revolutions around the Sun, so that the two planets return to very nearly their positions at the beginning. If then there is a transit on any given date, there will be another 46 years later, on the same or the following day of the month (unless indeed the first transit was very near to the edge of the Sun, in which case the repetition may fail). During each 46-year period there are at present four November and two May transits, as is illustrated by the following dates for the two centuries between 1800 and 2000 A.D.: November 9th, 1802; November 11th, 1815; November 5th, 1822; May 5th, 1832; November 7th, 1835; May 8th, 1845; November 10th, 1848; November 12th, 1861; November 5th, 1868; May 6th, 1878; November 7th, 1881; May 9th, 1891; November 10th, 1894; November 14th, 1907; November 6th, 1914; May 7th, 1924; November 8th, 1927; May 10th, 1937; November 12th, 1940; November 13th, 1953; November 6th, 1960; May 9th, 1970; November 9th, 1973; November 12th, 1986; November 14th, 1999.

All these are repetitions in regular order, as shown in the above dates, except that one of the two series of May transits "runs out" in 1937, leaving but a single such transit in each cycle until a new series begins, which, from the run of the numbers in the table, will be on May 6th or 7th, A.D. 2003.

The transit of 1894 was completely visible in the United States, and that of 1907 partially so, as will be the case this year. The next transits visible from this side of the world will be in 1953 and 1960.

On the present occasion the transit begins before the Sun has risen over this continent, at 5 A. M. by Eastern Standard time, and lasts a little more than four hours. It is half over before sunrise on the Atlantic coast, but the later phases, and especially the egress of Mercury from the Sun's disk, can be seen over a large part of the country. The extreme limit, along which the Sun will be rising as Mercury leaves his face, extends from Montana to Arizona, and the egress of the planet should be fairly well observable from points east of a line drawn from Texas to Minnesota.

The planet is too small to be seen without a telescope, being only 10 seconds in diameter, but a small instrument, if provided with a suitable shade-glass, will suffice to show it as a little black dot upon the Sun, perfectly round, and much blacker than any sun-spots which happen to be in sight (since the latter have some light of their own). The planet moves across the disk at the rate of five minutes of arc per hour, so that its shift will be apparent in a short time. It takes a little over two minutes to pass off the Sun's edge, the computed times of the first and last contacts between the borders of the planet and the Sun being 9 hours 7 minutes 17 seconds and 9 hours 9 minutes 31 seconds by Eastern Standard time for an observer who had the Sun right overhead. For stations in the United States the times will be a few seconds later. The point where the planet leaves the Sun will appear to be on the right-hand edge, a little above the middle, and the direction of the planet's apparent motion is upward and to the right.

The scientific interest of a transit of Mercury is not very great, being confined to the exact observation of the times of the apparent "contacts" of Mercury with the Sun's limb, which give valuable data for determining its exact position in its orbit. But the general interest of a phenomenon which cannot be observed again in this country for more than a generation should lead the amateur to observe it if he can.

At 11 o'clock : Nov. 7.
At 10½ o'clock : Nov. 14.
At 10 o'clock : Nov. 22.

At 9½ o'clock : Nov. 30.

At 9 o'clock : Dec. 7.
At 8½ o'clock : Dec. 15.
At 8 o'clock : Dec. 23.

NIGHT SKY: NOVEMBER AND DECEMBER

The Heavens.

As occasional queries arise about the explanation of the star-maps which appear every month on this page, it may be well to explain once more that they exhibit (as well as may be done on a flat sheet) the appearance of the sky as it would be seen by an observer lying on the ground and holding the map above him. The various points of the compass will in this case fall into their correct relative positions and the map will represent the sky. It may be more convenient simply to stand facing any given direction, and to turn the map about its center so that the corresponding point of the compass, as marked on its edge, is at the bottom. The lower part of the map will then show what stars may be seen in this region of the sky.

Proceeding in this way, we see at once that the southern sky is a dull region, occupied by the constellations Cetus and Eridanus. The southwest and west are little better, except for the great square of Pegasus, but the northwestern sky contains the fine groups of Cygnus and Lyra. In the north we see Draco and Ursa Minor, while Ursa Major is coming up in the northeast.

The eastern and southeastern sky is by far the finest region in sight, containing Taurus and Auriga high up, Gemini and Orion below, and Canis Major and Canis Minor still lower, whose two dog-stars, Sirius and Procyon, have just risen.

The Planets.

Mercury is practically invisible in the first half of the month, except at the time of his transit, already referred to. During the latter part of it he may be seen as a morning star, best about the 23rd, when he is at his greatest elongation. On this date he is in Libra, and rises about 5:15 A. M., so that he can easily be seen before the dawn gets too bright.

Venus is evening star until the 27th, when she passes through conjunction with the Sun, and becomes a morning star. She can be easily seen at the beginning of the month, in spite of her great southern declination of nearly 28 degrees, for she sets about an hour and a half after the Sun; but before November is half over she will be no longer accessible to observation with the naked eye.

This conjunction with the Sun is of unusual interest, for Venus comes apparently within 2 degrees of the Sun's center, and, when viewed telescopically, with proper devices for screening off the direct rays of the Sun, she should show very conspicuously the elongation of the horns of her crescent, due to twilight in her atmosphere.

Mars is still nominally an evening star, but is too near the Sun to be seen at all.

Jupiter is in quadrature with the Sun on the 6th, and counts thereafter as an evening star, as he crosses the meridian before 6 P. M. He is conspicuous in the southwest in the early evening.

Saturn is in the western part of Gemini and rises a little after 7 P. M. on the 15th, so that, though not yet in opposition, he is easily observable in the later part of the evening.

Uranus is in Capricornus, observable in the early evening, and Neptune in Cancer, where he may be seen telescopically in the small hours of the morning.

The Moon is full at 7 P. M. on the 2nd, in her last quarter at the same hour on the 10th, new at 11 A. M. on the 17th, and in her first quarter at 9 A. M. on the 24th. She is nearest us on the 17th, and farthest away on the 2nd and 29th. During the month she is in conjunction with Saturn on the 7th, Neptune on the 9th, Mercury on the 16th, Mars and Venus on the 18th, Uranus on the 22nd, and Jupiter on the 23rd.

Comets.

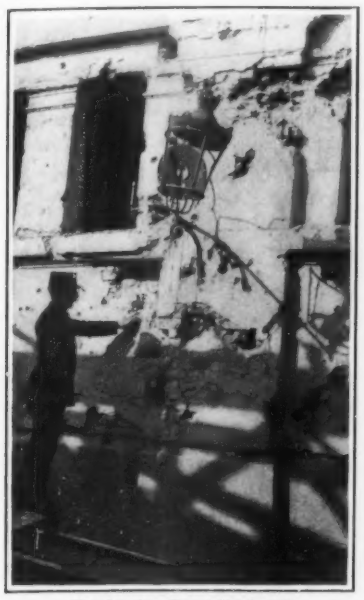
Delavan's comet is still well visible, though it has passed perihelion and is slowly diminishing in brightness. At the beginning of the month it is in Boötes, about 5 deg. northeast of Arcturus; and its motion is almost due southeast, at the rate of about 1 degree per day. On the 25th it passes close to α Serpentes, and continues southeastward toward δ and ϵ Ophiuchi, which it will pass about December 10th.

All through the month it is almost due north of the Sun, so that it can be seen about equally well in the morning and evening, but only just after dark or before dawn, as the case may be. Its theoretical brightness at the beginning of December is about 40 per cent of that at maximum (in October). This would leave it but little below the third magnitude, so that it should be easily visible to the naked eye.

A second comet, also visible for some time to the naked eye, was discovered on September 18th by Mr. Leon Campbell of the Harvard station at Arequipa, Peru, and independently at the Cape of Good Hope. It was then in the southern circumpolar constellation Doradus, but moved rapidly northward, and became visible in the United States on September 25th, when it was again independently discovered by Prof. Haggerty of Las Cruces, New Mexico. It continued to move rapidly northward and westward, and to grow fainter.

The first rough elements of its orbit (computed as usual at the University of California) show that it passed perihelion some time ago on August 4th, at a distance of sixty-four million miles from the Sun. When first seen it was almost directly below the plane of the Earth's orbit, and only about thirty million miles away. The plane in which it moves is inclined nearly 78 degrees to that of the ecliptic, and its motion took it rapidly upward and outward, so that between September 18th and October 10th it described an arc of 90 degrees in the heavens and passed from the south pole of the ecliptic to the ecliptic itself. A diagram shows that it was closest to us about September 25th, when it

(Concluded on page 358)



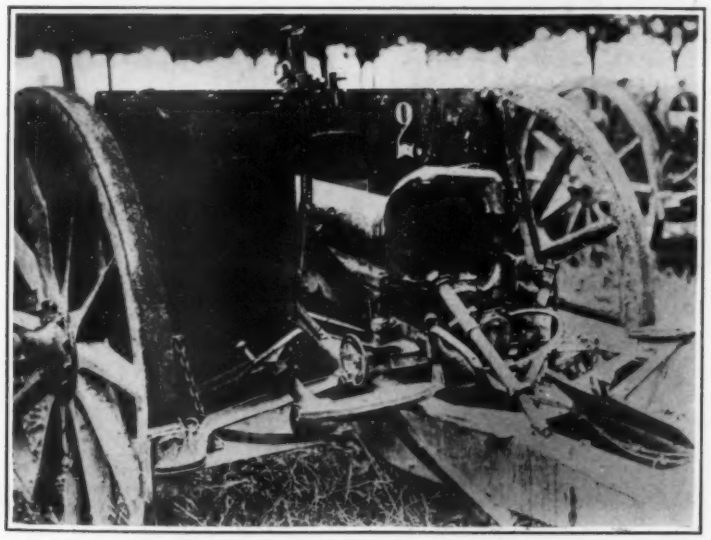
Work of a Zeppelin bomb.

Hole in a street in Maastricht, produced by an aeroplane bomb.

Pine tree nearly severed by a shell.

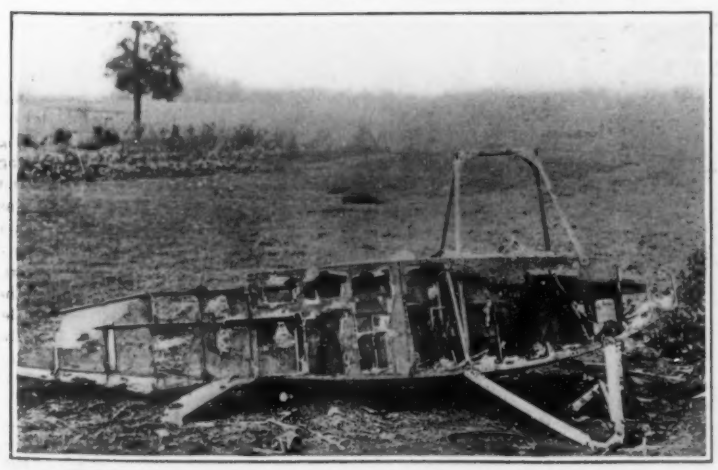
Searchlights in London guard against an aerial attack.

Sleeping quarters of the Royal Naval Volunteers in Crystal Palace.



Deserted German field gun with breech destroyed.

Train destroyed by the blowing up of a bridge across the Ourcy.



Wreck of a Taube aeroplane shot down by the British.

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International News Service

Belgian armored train in action at Antwerp.

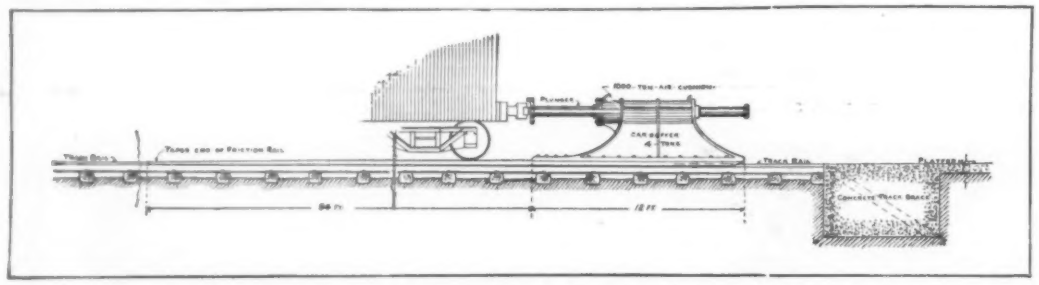
PICTURES FROM THE FRONT

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

A Sliding Car Buffer

ONCE in a while, owing either to miscalculation upon the part of the engineer or failure of the air-brakes, a train enters a terminal station with such velocity that it cannot be stopped before reaching the end of the track. To bring the train to a halt when it is not under proper control, buffers of various designs have been used, but it is no simple matter to design a bumper that will stop a train without, on the one hand, doing harm to the train, or, on the other, being seriously damaged itself. Recently a car buffer has been invented which is not rigidly secured to the end of the rails, but is designed to slide upon the rail when the momentum of the train is greater than a certain predetermined amount. This buffer is formed with two long shoes or tapered friction rails that rest upon the track. The train rides up on these shoes, and if not stopped in time strikes a plunger projecting from a pneumatic cylinder. The air cushion back of the plunger serves to retard the motion of the train; but if it is unable to stop it, the whole buffer slides along on the rail, until the section between the buffer and the rail is sufficient to overcome the momentum of the train. In a recent test of this buffer, it was found that a 1,000-ton train traveling at three miles per hour was brought to a stop without sliding the buffer. At four miles per hour, the buffer slid 9 inches. At 8 miles per hour the displacement of the buffer was 3 feet; at 16 miles, 12 feet; and at 32 miles, 40 feet. Of course it is seldom that a buffer is called upon to stop a train traveling more than three or four miles per hour. After the rails have been displaced over 12 feet the rate of friction runs up extremely high and overcomes the momentum with greater relative ease. Because the buffer yields before the impact more or less in proportion to the speed of the train, no damage is done and the train is halted in the shortest distance compatible with safety.

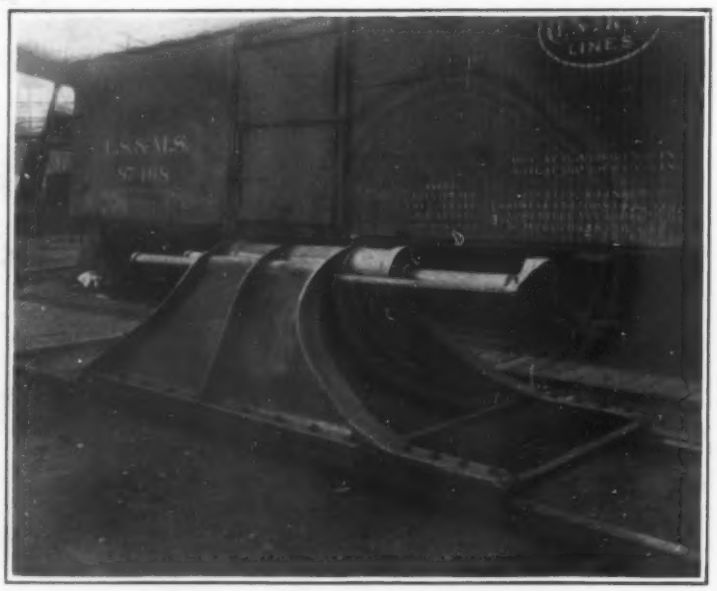


Sketch of the sliding car buffer, showing the long tapered shoe or friction rail.

Misdirected Inventive Effort

FREQUENTLY we see in invention, as in other fields of human activity, failures resulting from misdirected effort. One phase of this is found where useful and ingenious improvements are made in arts in which the demand is so limited as to preclude adequate reward. Another is where the invention is made ahead of the demand. The attention of inventors is, therefore, invited to some almost unlimited fields. Take, for instance, the equipment of a military force. Today, if one could provide in any part of the clothing, furnishings, or accouterments of a soldier, an article of less weight and equal service or of better service with the same weight, or which possessed radical advantages of any character, an enormous market would be clamoring for a supply of the devices. Consider for a moment the demand for a man's sock that could be produced at the same cost and would give twice or any appreciable wear in excess of the ordinary ones on the market. If you are a chemist and can reduce the cost of sugar production or refining the smallest fraction of a cent per pound, or can produce a better or cheaper laundry soap, would you have to do more than demonstrate the proposition to reap a reward? A few weeks ago the SCIENTIFIC AMERICAN told of a large sum having been paid for a simple improvement in cameras. It was worth the large sum because the tremendous field for its application was already in existence. The inventive are, therefore, urged if not actively engaged in connection with a commodity of a large proportion, to seek a field in which the product of the inventive act will find a large demand in reasonable time.

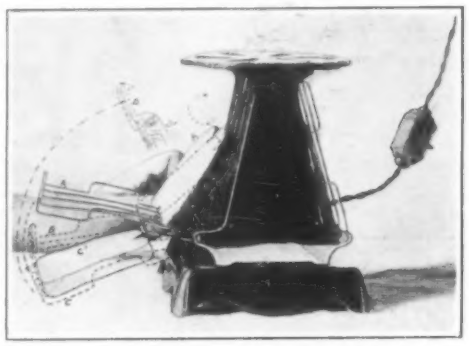
It will be readily seen, from the instances furnished, that the range is sufficiently wide to enable any well-sustained effort to develop a successful inventor, one who should win a corresponding financial reward.



The pneumatic plunger of the buffer head.

An Electric Toast Maker

SINCE the introduction of cooking by electricity many small pieces of apparatus have become popular on account of their convenience. One of the favorites is the toaster, which can be connected with an electric light fixture, and operated directly on the breakfast table. In most of the devices of this kind it has been necessary to handle the hot toast with the fingers, but



An electric toast maker.

a new device that has recently appeared does away with this objection.

In the apparatus in question the heating elements, two in number, are set nearly vertical, with an inclination toward each other at the top, and the slices of bread are supported in the toasting position by wire grids on either side that are attached to pivoted rods across the base of the apparatus. When one side of the slice has been toasted it is not necessary to turn it with the hand to present the other side to the heating element, but the pivoted rod at the base is simply turned, dropping the supporting grid outward, as shown at *A* in the drawing. The inwardly turned fingers at the lower end of the grid coming in contact with the lower side of the slice of toast press it outward, and it slides down on the grid as shown at *C*, C^1, thus reversing the position of the piece of toast in relation to the heating element. On turning the grid up again, as shown at *D*, D^1, the untoasted side is presented to the action of the heating element. This entire operation requires only a few seconds, and as the hot slice does not have to be handled to reverse it, and as the operating knob is so placed that it does not become hot, the making of toast with the new apparatus becomes both convenient and agreeable.

Some Adjudicated Patents

AMONG the recent United States adjudicated patents may be noticed the following: The Wolhaupter patent, No. 538,809, for railway-tie plates, held void for lack of invention in view of the prior art in Railroad Supply Company v. Elyria Iron and Steel Company; the Marconi reissue patent, No. 11,913 (original No. 586,193), for an apparatus for wireless telegraphy, claim 3 held valid, but not infringed in Marconi Wireless Telegraph Company of America v. National Electric Signaling Company; the Lodge patent, No. 609,154, for improvements in apparatus for wireless telegraphy, held valid and infringed in Marconi Wireless Telegraph Company of America v. National Electric Signaling Company; the Wolhaupter patent, No. 691,332, for railway-tie plates, held void for lack of invention in view of the prior art, in Railway Supply Company v. Elyria Iron and Steel Company; the Wolhaupter patent, No. 721,644, for railway-tie plates, held void for lack of invention in view of the prior art in Railroad Supply Company v. Elyria Iron and Steel Company; the Jerrems patent, No. 745,625, for feeding mechanism for grass-twine machines, held valid, but not infringed in Steiger v. Waite Grass Carpet Company; the Marconi patent, No. 763,772, for apparatus for wireless telegraphy, held valid and infringed in Marconi Wireless Telegraph Company of America v. National Electric Signaling Company; the Nathan patent, No. 799,662, for a cover for automobile tires, held infringed in Allen Auto Specialty Company v. Niagara Auto Cover Company; the Jerrems patent, No. 824,871, for feeding mechanism for grass-twine machines, held valid, but not infringed in Steiger v. Waite Grass Carpet Company; the Layne patent, No. 821,653, for a rotary pump, held valid and infringed as to claim 20 and not infringed as to claims 4 and 13, in Van Ness v. Layne; the Hildreth patent, No. 832,384, for a candy-pulling machine, claim 4 construed literally and according to its natural import, is void as covering more than complainant actually invented in Hildreth v. Lauer & Suter Company.

Labels With Trade-mark Features

IN *ex parte* Wahrmann, Commissioner Ewing has held that where the matter presented is properly a label and is distinctively original, the statute does not prevent registration because the feature which gives the label originality is used or is capable of being used as a trade-mark, saying in the course of his decision, "the label in question is not a trade-mark and no trade-mark rights are acquired by registering it."

Shuttle "Kissing" in England.—United States Consul Ingram, of Bradford, England, refers to the threading of shuttles by the quick sucking motion known as "kissing the shuttle" and to the dangers resulting directly from the inhalation of lint and dust and the further danger of infection as shuttles are interchanged. It appears that disinfectants are employed and reference is made to the fact that one weavers' association in a report suggests that the real remedy is a self-threading shuttle, while another association expressed the opinion that a regulation making the use of self-threading shuttles compulsory could be made without any harm to the trade. While self-threading shuttles have been devised, it would seem that the field, in the event of compulsory regulation, is sufficiently large to encourage improvements.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

SHIRT AND TROUSERS SUPPORT.—J. A. ERWIN, Ozark, Ark. This invention provides a support arranged to hold the shirt down and the trousers up without undue strain on the wearer's body, at the same time giving the desired comfort and allowing free movement of the arms, shoulders, and upper portions of the wearer's body.

Pertaining to Aviation.

AEROPLANE.—H. L. COAKLEY, 207 W. 14th St., Manhattan, N. Y., N. Y. By this invention Mr. Coakley is enabled to control by a single and simple expediency all of the movements of the aeroplane while in the air. The controlling devices, including a plurality of controlling planes, are arranged preferably at the rear, said planes being journaled on substantially horizontal axes extending transversely of the line of flight but at an angle to each other.

Electrical Devices.

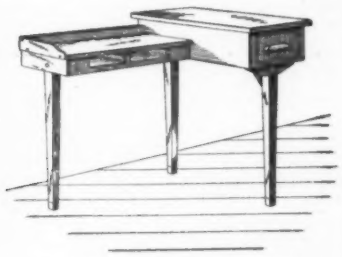
ELECTRIC BELL RINGER.—W. V. BERGEN and G. C. COMBS. Address the former, Hillsboro, Wash. This invention is of that type which consists of a reciprocating striking element or hammer located in proximity to the bell or gong to impinge upon the same, the device being especially useful in connection with fire or other alarm boxes and other signal devices, where the bell sound is transmitted over great areas.

ELECTRIC HEATER.—H. A. GAMBLE, Greenville, Miss. This invention is an improvement in electric heaters for drop enema, and has for its object the provision of an inexpensive and easily operated heater for maintaining a uniform temperature in the solution during its administration.

Of General Interest.

MOLD FOR PLASTIC MATERIALS.—C. DE MURGUIONDO, 103 Sixth Ave., Brooklyn, N. Y. This mold is particularly adapted for molding window-sills from cement or analogous plastic material. The adjustable ends having been slid along to the place required by the length of the sill to be molded, the box-like cavities on each side of the central board are filled with plastic material, and the same is scraped and smoothed at the top to form a surface flush with the top of the mold.

SECTIONAL TYPEWRITER DESK.—J. G. LANGDON, 1226 Munsey Bldg., Baltimore, Md. An object of this invention is the provision of a desk for a machine, and one combined with it for holding supplies, such as stationery and the like, the latter being also capable of use as



SECTIONAL TYPEWRITER DESK.

a writing desk for stenographic purposes. It provides a combined typewriter's and stenographer's desk of a novel form, which consists of detachable sections so that the stenographer's desk can be placed on one side or the other of the typewriter's desk.

CONTAINER.—C. J. ALLERS, 24 Hawthorne St., E. Orange, N. J. An object here is to provide a container which may be stamped from a single block and folded so as to produce a tight receptacle capable of carrying liquid, and with securing or locking attachments for preventing the accidental unfolding or opening of the container.

METALLIC CONTAINER.—P. D. HAM, care of J. E. Prescott, Passaic, N. J. This invention relates to containers for containing shoe blacking, polishing preparations, paints, salves, etc., and provides a container having a tight-fitting cover and means for removing the cover from the body of the container and without the danger of the operator soiling the hands or spilling the contents of the container.

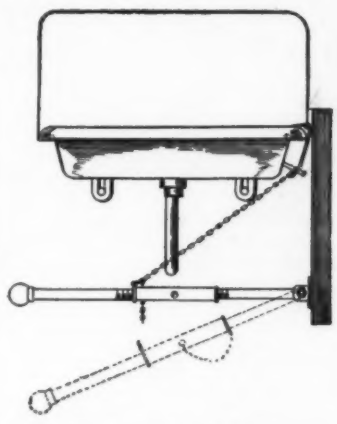
SHEET METAL PARTITION.—C. W. SANDERS, 1125 Princess Ave., Victoria, B. C., Canada. It is the design of this inventor to provide a partition to receive metal lathing and formed of sheet metal instead of more solid cast or rolled metal elements, whereby the partition may be much more cheaply produced.

MEANS FOR CLOSING AND LOCKING PORT HOLES AND THE LIKE.—W. V. GILBERT, Cambridge, England. This invention relates to means for closing and locking a port hole of a ship or an orifice in any other device of the kind comprising a carrier, which may serve as the closing piece, mounted on the ship's hull so as to turn about a hinge pin or equivalent in a plane axially and laterally clear of the port hole; a movable locking member, which may serve as the closing piece, co-acting with the carrier and the hull; and means for operating the carrier and locking member in the open position of the carrier.

BRUSH.—L. W. BULLARD, Cumberland, Md. This brush is especially adapted for use in applying oils and other liquid lotions to the skin and for applying liquid polishes to shoes and other leather goods, wherein a brush is provided having means for engaging a bottle to connect the brush to the bottle in such manner that the contents of the bottle may pass out on to the operative face of the brush.

Household Utilities.

DRAINING TABLE FOR SINKS.—H. E. M. KENSIT, 137 24th St., East Prince Albert Sask., Canada. This folding draining table has the special features that the same fittings will suit any standard type or size of sink and that it requires no attachment to a wall or floor. It is immediately removable from one sink to



DRAINING TABLE FOR SINKS.

any other or to a laundry tub. The height is adjustable for any standard sink or tub, and the folding leg swivels in any direction to clear obstacles under the sink. It is applicable to any sink, but is especially designed for cases where a door or passage makes a permanent fixture impossible or where space is important.

Pertaining to Vehicles.

VALVE FOR PNEUMATIC TIRES.—J. W. TAYLOR, 1440 Lyons Ave., Lansing, Mich. In the present invention the improvement has reference to a valve for pneumatic tires, the inventor's object being the provision of certain means by which to eliminate the danger of leakage and preserve and hold the flexible gaskets or washers utilized therein.

AUTOMOBILE SIGNAL.—J. A. ROSS, 115 W. 46th St., Manhattan, N. Y., N. Y. Among the objects of this invention is the provision of a device for use especially on the rear ends of automobiles, under the control of the chauffeur or other occupant of the vehicle, but indicating to persons back of the automobile the intended movements of the automobile.

SLIDING DOOR.—F. S. ADAMS and W. H. RICKARD, Pueblo, Colo. The improvement is in sliding doors, for automobiles and like vehicles, wherein the body of the vehicle is provided with a recess adjacent to each door opening, for receiving the door, and wherein the door is mounted to slide into and out of the recess, and wherein mechanism operates from the seat, for opening and closing the door, and wherein normally active mechanism locks the door in closed position, the said mechanism being arranged in such manner that it may be released from the seat.

AUTOMATIC AIR SUPPLY SYSTEM FOR AUTOMOBILES.—W. C. BAKELS, Ridgewood, N. J. This invention provides an ever-ready automatic air supply system for automobiles and the like, adapted to utilize the exhaust from the motor for the purpose of storing air under pressure to be utilized for the operation of the brakes, inflation of the tires or for other purposes.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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(Concluded from page 349.)

Navy Department lopped off $1,107,860 from the prices which prevailed during the previous year! Bids for 3,500 14-inch armor-piercing shells, 1,500 12-inch armor-piercing shells, and 30,000 4-inch and 5-inch common shells for the use of the Navy were awarded early in the year with a decrease of $889,825 in the bids for the quantities specified or of $1,107,860 if advantage were taken of the right to increase the orders 25 per cent over the original contract. This right will be exercised.

The greatest cut in prices on any one item was made by the Bethlehem Steel Company, which secured contracts for 4-inch common shells last year at $9.50 each, and this year offered to take the entire lot of the same shells at $5.46 apiece, or a little more than one half of last year's price. The Crucible Steel Company cut their bids on 14-inch armor-piercing projectiles from $500 in 1913 to $300 in 1914, while the Bethlehem Steel Company's bid dropped from $500 to $320.

The $150,000 or more which has been saved to the Navy within the past year through the reclamation of copper is only a single illustration of the unrecognized wealth which long lay within the grasp of the Government only to be allowed to slip through the fingers of the administrators.

The scrap metal which accumulates so rapidly at every navy yard and gun factory contains a considerable percentage of copper. Formerly this metal was either sold outright for a fraction of its value or was turned over to the "outside" refineries, which were supposed to extract the copper and return it to the Government. About 20 per cent of the metal was returned as copper under this method. Within the past year, however, it was decided that it would be more economical for the Government to extract its own copper and thus insure full value. Experiments with the scrap metal showed that the return of copper, when the extracting was done under Government supervision, amounted to about 60 per cent of the gross weight! Under present conditions no copper scrap is turned over to outside firms, but it is all treated by the Government. The returns have been so great that the Navy Department has not had to buy any copper during the past year. As the amount of copper annually used by the Navy was well over 1,000,000 pounds, at 15 cents a pound, the saving by the present method is considerably in excess of the $150,000 listed in the summary of the year's savings.

The economy in other scrap metal—estimated by Rear Admiral Cowie, Paymaster General of the Navy, at about $300,000—has been effected mainly through expert supervision of the disposal of the scrap and the efforts of the Department to place the metal on the best possible commercial basis.

The $500,000 saving credited to "food, clothing, and other supplies" was effected by watching the markets closely and buying in large quantities when the prices were lowest. For example, $20,000 was saved on cloth in a single contract and $5,000 on one purchase of sugar. Scarcely a week passes without a considerable saving being effected on some item for which contracts are opened every Tuesday. The paymasters in charge of this work are authority for the statement that the saving within the past fiscal year amounted to fully half a million dollars, and it is probable that as much more will be pared off during the coming year.

Through the medium of the same careful watching of all expenditures, no matter how small, the Department has been enabled to save not less than $143,423 on the requisitions which have been made by various ships and navy yards throughout the year. This is clear profit, because quality was not sacrificed in a single case. The economy was effected by buying in large quantities, by eliminating unnecessary articles from the requisitions and by strictly enforced competition in the submission of bids.

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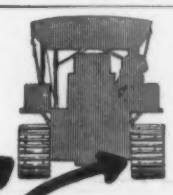
Inquiry No. 9406. Wanted the name and address of a manufacturer who can supply insole material in rolls. The material seems to be scrap leather composed and attached to a canvas bottom.



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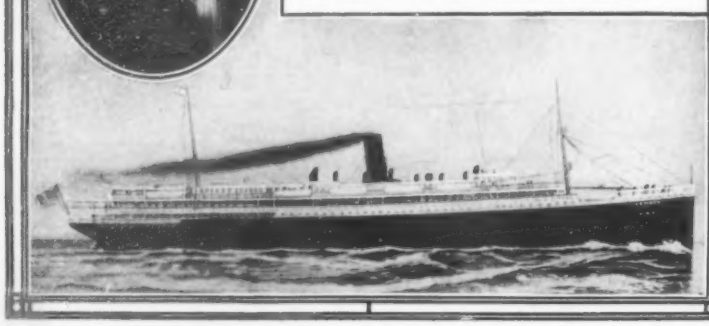

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the Atlantic Fleet during its European cruise last fall saved the Government about $75,000. It had formerly been the custom of the Department to purchase coal at the various ports where the fleet called. This naturally resulted in raising the price of coal in anticipation of the arrival of the American ships, and the experiment of having the colliers accompany the fleet was so successful that the old method will not be reverted to.

The other two savings noted in the summary—the transportation of men and materials and the construction of the channel at Mare Island, Cal.—were the direct result of the new policy of substituting real competition for the spurious kind.

In future the former brand will be the only one recognized by Uncle Sam, and the Navy Department will try to outdo its own record of saving $10,000 a day for an entire year.

The Heavens in November

(Concluded from page 354.)

was only about twenty million miles away.

By the beginning of November it will be about one hundred million miles from us and one hundred and sixty million from the Sun, and less than one fiftieth as bright as when nearest us, so that it will be visible only with telescopic aid.

The preliminary ephemeris, which alone is at hand as this is written, ran out on October 14th, but a rough extension shows that on November 1st the comet will be near ε Pegasi and observable almost all night long.

Encke's comet, whose period of three years and three tenths is the shortest known, is once more under observation, having been found by Prof. Barnard on September 17th. It was then in Perseus, and high in the heavens for most of the night; but as it was of the fourteenth magnitude, it is not likely to be observed with any but the greatest telescopes.

Princeton University Observatory.

Tempering Bronze

ALTHOUGH hardening bronze has long been considered as one of the celebrated lost arts, still it is certain that it may be hardened by heat treatment. Guillet's experiments in this direction show that some of the bronzes, namely, those containing 15 to 20 per cent of tin, may be made malleable when heated, although they are brittle when cold. Making tests of copper alloys with various percentages of tin, from 5 to 21, and with temperatures ranging between 300 deg. and 800 deg. Cent., he found as follows:

1. Alloys with more than 92 per cent copper are made more resistant to breakage by tempering at from 400 to 600 deg. Cent.: the ductility increasing with the temperature employed.

2. Alloys with less than 92 per cent of copper are increased in resistance to breakage and in ductility in still greater proportion by heating to temperatures above 500 deg. Cent. The greatest tensile strength was attained, with all specimens, by treating them at about 600 deg. Cent. The maximum extension in length seemed however, to depend on the composition of the alloy. With bronze having 81 copper to 19 tin, it occurred at 800 degrees; with 79 copper and 21 tin at only 600 deg. Cent. The difference in tensile strength between untempered castings and those tempered at the proper degree of heat is greater in inverse proportion to the percentage of copper. In general, it may be said that tempering bronze at heats between 600 deg. and 800 deg. Cent. has its principal effect in increasing the tensile strength.

As regards the effect of tempering on the co-efficient of friction, this will be taken up in later experiments.

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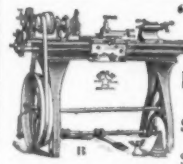

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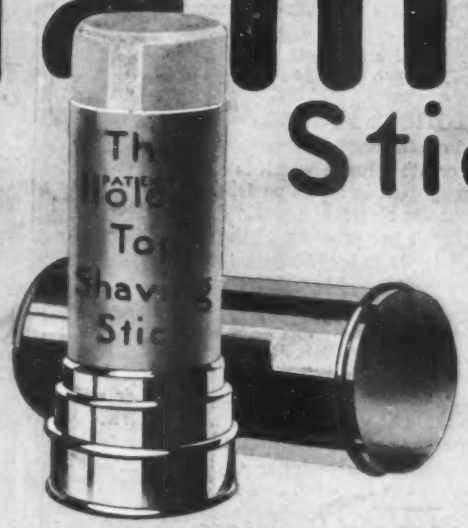

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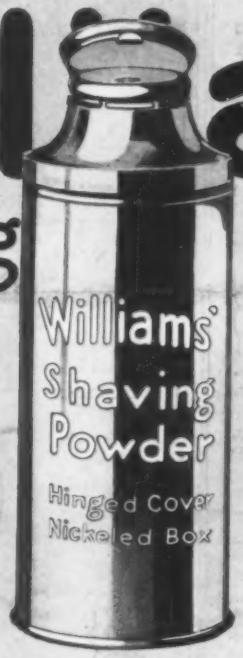

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